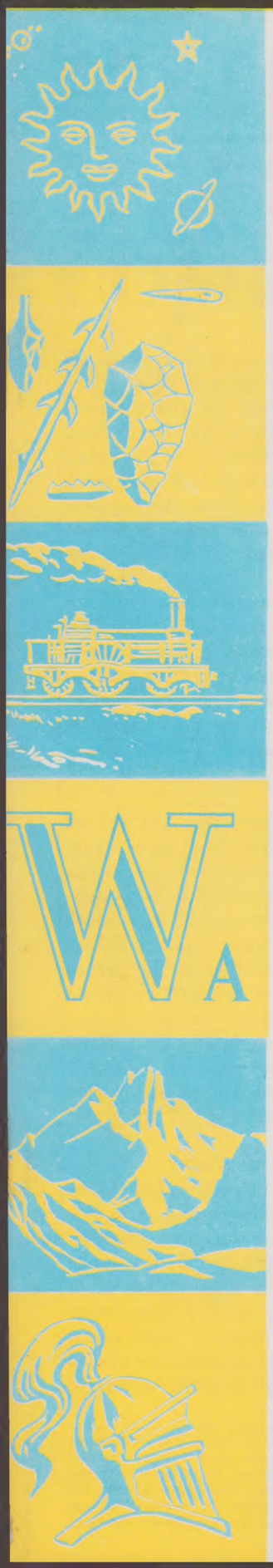
KNOWLEDGE

NO. 139 VOLUME 12 The colour magazine which grows into an encyclopaedia EVERY MONDAY 2/-



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WATER

WATER is the most plentiful of all the substances which form the earth's crust. The oceans and the seas cover about 141,000,000 square miles, or 71 per cent of the earth's surface, and in many places are 5 or more miles deep. Their total volume is estimated at 330,000,000 cubic *miles*, or enough to cover the whole of the earth's surface $1\frac{3}{4}$ miles deep.

Compared with this prodigious amount of salt water the amount of fresh water in the world is relatively small. Altogether the rivers, the lakes, and the great underground stores called aquifers, contain only about 1/2700th of the amount of water in the sea. Even so, 125,000 cubic miles of fresh water is still a vast amount. It would cover the earth to a depth of 3 feet, or supply the needs of London for a million years.

Now although there is never any substantial alteration in the volume of salt water in the sea or in the volume of fresh water on land, there is, nonetheless, a constant and extensive interchange between the two. This interchange is called the *hydrologic cycle*. Without it there would be no rain; without rain there would be no land vegetation; and without land vegetation life as we know it would disappear.

The hydrologic cycle

The hydrologic cycle depends on the fact that water evaporates, or slowly turns into water vapour. Evaporation mostly takes place at the surface of the sea, where vast quantities of sea water are constantly turning into water vapour and being blown away by the wind. The higher the temperature of the sea, the faster evaporation proceeds, for it is a process which needs heat. In tropical latitudes, therefore, where the sun shines fiercely on the sea all day, the rate of evaporation is much greater than in the cold polar regions. We must remember, however, that in the evaporation process it is only the water which turns into vapour. The sea salt is left behind in the ocean.

The amount of water vapour that the air above the sea can contain depends on the air temperature. At sea level in tropical latitudes the air is warm, and under these conditions it can hold a large amount of water vapour. But when this warm air rises it cools, and the amount of water vapour which it can then hold is much smaller. As a result some of the vapour *condenses*, or turns back into water. The water formed like this is in drops so minute that they remain suspended in the air, where they form the masses that we know as clouds.

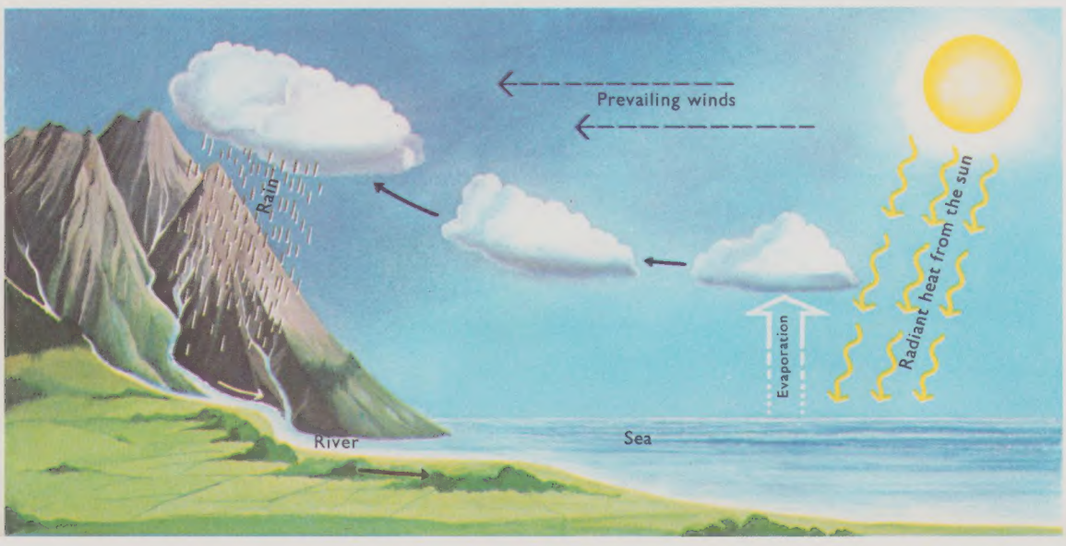
Rain

Sometimes the minute drops of water in newly formed clouds join together into drops which are too large to remain suspended. When this happens the large drops fall uselessly back into the sea as rain. On other occasions the drops remain small and are blown about as great banks of cloud by the prevailing winds. Should these clouds be blown over land they may reach a range of hills and thus be blown higher. When this happens there is a further fall in temperature, more water condenses out, and large drops of water are formed which fall on the land below.

Some of the rain which falls on land evaporates into the air, some percolates through the soil into the deep layers, and some runs almost immediately into rivers in which it flows back to the sea, thus completing the cycle. A relatively small amount of water finds its way into plants, into animals, and into various other situations which delay its return to the sea. Sooner or later, however, even this water escapes and eventually returns to the oceans, from whence it can pass round the cycle once again.

The amount of rain which falls on a particular area of land depends on the land's geographical position. Thus in one part of Hawaii, over which water-laden clouds from the Pacific Ocean are blown almost continually, the annual rainfall is 460 inches. On the other hand, the dry winds from Europe and Asia which blow over North Africa carry almost no water at all. They are responsible for the dryness and the desolation of the Sahara Desert. The average annual rainfall over the five populated continents of the earth has been calculated as 38·1 inches. This is equivalent to 35,000 cubic miles per year, or 34,000 gallons each day for each person in the world.

The hydrologic cycle: water evaporates from the sea, condenses into clouds which are blown inland, cools further and falls as rain, then runs down rivers and back into the sea to repeat the cycle



Sources of water

There are only a few places in the world where rainfall is sufficiently heavy and predictable for it to be used directly as a water supply. In most places it is necessary to find some more reliable source, particularly when large amounts are needed to supply a great industrial town.

Previous page: A model of a water molecule with one atom of oxygen bonded to two atoms of hydrogen; an ice crystal with the characteristic six-pointed shape; a prehistoric man drinking water from his cupped hand.

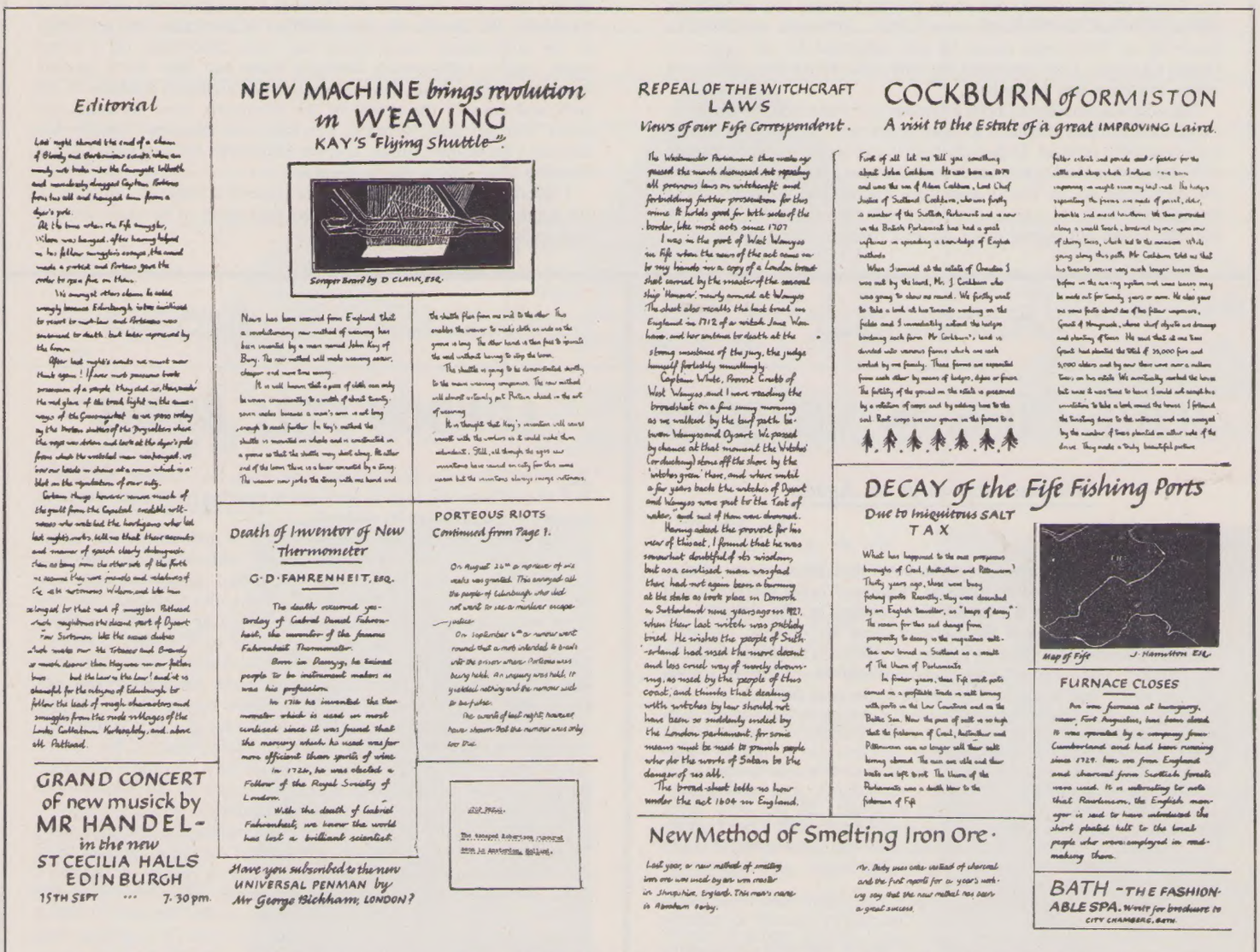
KNOWLEDGE NEWS

Week beginning 1st September 1963

HISTORICAL NEWSPAPER COMPETITION results

THE overall winner in the *Knowledge* Historical Newspaper Competition is Kirkcaldy High School, Kirkcaldy, Fife. This school receives a cheque for £50. The final selection was made by Christopher Brooke, MA, Professor of Mediaeval History at Liverpool University, and a member of the *Knowledge* Advisory Editorial Board. The winning entry was in the 11–14 age group and was on the Porteous Riots. Another entry in the 11–14 age group ran it very close; this was from Ellon Academy, Ellon, Aberdeenshire, and was on Napoleon at Moscow. Professor Brooke also specially commended the winning entry in the under 11 age group – from the Sacred Heart Primary School, Ruislip, Middlesex, on the Great Fire of London.

Over 1,000 entries were received from Britain, the Commonwealth and South Africa. The competition was divided into three age groups, and in each there was a first prize of £25, a second of £15, and a third of £10. The best entry of all received £50. The entries were, on the whole, of a very high standard, and set the judges a hard task. The judges looked for a journalistic approach, coupled with accuracy, and an intelligent appreciation of the situation. Attractive lay-out also helped them to decide their choice. On pages two and three are published commentaries on the three winning entries in each of the three age groups.


Editorial
NEW MACHINE brings revolution in WEAVING
KAY'S "Flying Shuttle"
Scraper Board by D CLARK, ESQ.
Death of Inventor of New Thermometer
G·D·FAHRENHEIT, ESQ.
PORTEOUS RIOTS
Continued from Page 1.
GRAND CONCERT
of new musick by
MR HANDEL
in the new
ST CECILIA HALLS
EDINBURGH
15TH SEPT ... 7.30 pm.
Have you subscribed to the new UNIVERSAL PENMAN by Mr George Bickham, LONDON?
REPEAL OF THE WITCHCRAFT LAWS
Views of our Fife Correspondent.
COCKBURN of ORMISTON
A visit to the Estate of a great IMPROVING Laird.
DECAY of the Fife Fishing Ports
Due to Iniquitous SALT TAX
Map of Fife
J. Hamilton Esq.
FURNACE CLOSES
New Method of Smelting Iron Ore.
BATH - THE FASHIONABLE SPA. Write for brochure to CITY CHAMBERS, BATH.

The centre page spread of the winning entry from Kirkcaldy High School; the layout is attractive and there is an intelligent choice of features

The overall winner and the best entry in the 11-14 age group came from:
Kirkcaldy High School, Oswald Road, Kirkcaldy, Fife.

PORTEOUS LYNCHED BY MOB

Captain of City Guard hanged from dyer's pole

8th September, 1736

'Captain Porteous is dead. Late last night a well-organised mob broke into the Tolbooth Prison, dragged Porteous from his room and hanged him from a dyer's pole in the Grassmarket . . .'

THE *Edinburgh Gazette* goes on to give a vivid account of how Porteous was dragged from the Tolbooth despite his attempt to escape up the chimney, and lynched by the furious Edinburgh mob. The second story gives a concise account of why the lynching took place. Porteous, Captain of the City Guard, had accidentally caused the death of 17 people who had gathered to witness the execution of a smuggler. To keep order he had commanded his men to fire above the heads of the crowd, but some people leaning out of upstairs windows or on nearby roofs were killed. Although sentenced to death by an Edinburgh court, he was reprieved for six weeks by Queen Caroline. This infuriated the mob, who broke into the prison where Porteous was being held.

The editorial condemns both Porteous and the mob: Porteous for using such extreme methods to keep order, and the mob for taking such a terrible reprisal. It does its best to exonerate the good people of Edinburgh, pointing out that the ring-leaders probably came from the other side of the Forth, and were friends and relatives of the smuggler. It ends on a note of sympathy for the smuggler, stressing that the excise duties had made ale and tobacco much dearer.

The features show an intelligent appreciation of what was considered important at the time: the news from England about Kay's 'Flying Shuttle', which brought a revolution in weaving; the death of G. D. Fahrenheit, inventor of the Fahrenheit thermometer; the impoverishment of the Fife fishing ports because of the new salt tax.

The problems of agriculture obviously preoccupied many Scots of this time, and there are two articles about improved agricultural methods. Witchcraft was also a subject of particular interest – only in the last century witch hunts had been undertaken on a grand scale, and in 18th-century Scotland there had been some terrible burnings at the stake. The newspaper has a careful analysis of the pros and cons of the repeal of the witchcraft laws. Religion and sport, too, get their mention. The Reverend Ebenezer Erskine has formed a Secession Church, and the Edinburgh Burgess Golf Club is thriving after only a year's operation.

Underlying the whole newspaper there is a resigned criticism of the English government for the effect that many of its measures had had on Scotland.

First prize of £25 *in the over* 14 *age group went to:*
High School, Thurso, Caithness.

ACUTE CRISIS IN MOROCCO

'Panther' moves in on Agadir

4th July, 1911

'LIKE a bolt from the blue comes the news that the German government has despatched the gunboat "Panther" to the Moroccan port of Agadir which holds a commanding position on the Atlantic sea coast. The implications of the German move are obvious. Not only does the prospect of a German seizure of Morocco constitute a threat to Gibraltar, but Franco-German relations may be strained to a point where a major war would be foreseeable in the near future.'

In these grave and measured terms the *Northern News and Caithness Chronicle* describes the Agadir crisis. Readers are given world reactions: in Paris resentment against the Germans is high; in Rome there is a 'wait and see' attitude; in Vienna there is doubt; in St Petersburg apathy; and in Berlin confidence and enthusiasm. English reaction, too, is carefully analysed: 24 per cent think England should take action; 68 per cent do not; and 8 per cent do not know. One member of the public who was interviewed thought that Germany was 'getting too big for her boots', and this view is echoed by the editorial.

But other crises besides German imperial ambitions have come to the fore. The controversial Parliament Bill designed by Asquith to curb the powers of the House of Lords is causing great disquiet among Conservatives, and suffragettes are on the march. There are several interesting snippets of news. A £2,500 prize has been won for the fastest Channel flight. The grandson of Gladstone has been made Lord-Lieutenant for Flintshire. The King inspects a fleet of Dreadnoughts at Plymouth.

First prize of £25 *in the under* 11 *age group went to:*
The Sacred Heart Primary School, Ruislip, Middlesex.

LONDON STILL BURNS

5th September, 1666

'BECAUSE of the great disaster our rival, the "London Gazette", has not been able to go to press and so we bring you the first accurate account of the fire since its outbreak. . . .'

This is how the *Ruislip Clarion* began its account of the Great Fire of London. Judging by the delight with which its reporters tackled their job the fire was one of the best things that had happened in the newspaper's history! It noted with satisfaction that the King was playing his part, actually endangering himself in helping to blow up houses. An old score was paid back against the Lord Mayor of London who 'proved himself a person of weak character and little initiative'. The *Clarion* maliciously recounted how Mr Pepys, the Navy Secretary, had found him 'crying like a fainting woman'. Although the editorial sternly points out that it is time real thought was given to organised and scientific fire fighting, the view of the paper is that the Fire of London might be a blessing in disguise. Already, while London still burns, the name of Sir Christopher Wren is being mentioned as a possible rebuilder.

But the fire has not completely preoccupied the editorial staff. There is a report of a witch being burned at the stake; the execution of a highwayman; news from the colonies; a review of Dryden's latest play. New styles in coaches are noted; Nell Gwyn was seen looking very smart in Hyde Park with an escort. The cost of living comes under review; the iniquitous price of meat (3*d.* a pound) and butter (6*d.* a pound) are remarked upon. Coach trips to Exeter, taking four days for 40*s.*, and to Durham (no time of arrival guaranteed) for 55*s.* are offered.

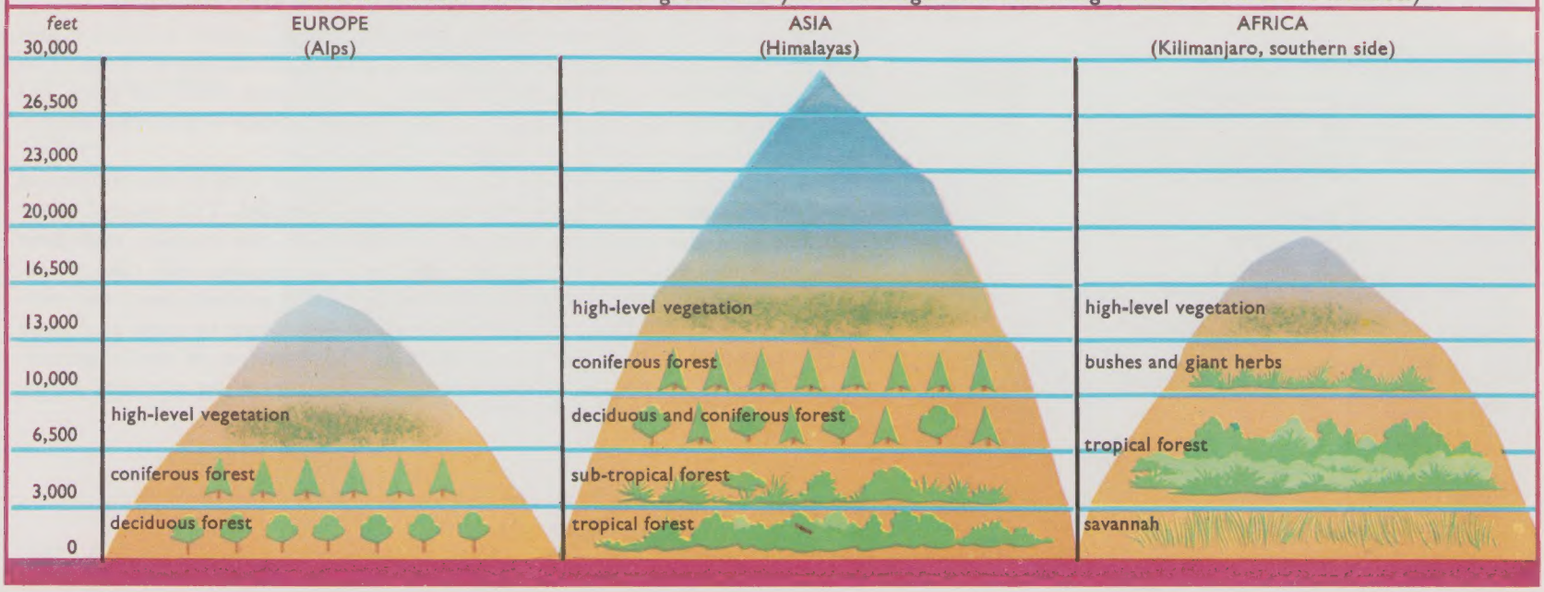
MOUNTAIN VEGETATION

EVERY student of geography knows that the vegetation changes as one journeys from the equator to the poles. Near the equator there is tropical forest, which gives place to deciduous forest in temperate regions. The word 'deciduous' is applied to trees which are left bare for part of the year when their leaves fall; they are characteristic of regions with a mild summer and a moderately cold winter. Further towards the poles there is evergreen coniferous forest, composed mainly of pine and fir trees ('conifers') and beyond that a treeless region in which the only vegetation is low-growing plants, mosses, and lichens. These *zones* of vegetation are, of course, determined by the increasingly severe climate which prevails towards the poles.

Now if you climb a high mountain it gets colder the higher you go; the climate, in fact, becomes increasingly severe. In the Himalayas you can start climbing in a subtropical climate and come eventually to glaciers and perpetual snow. The changes in vegetation on the way will be of very much the same kind as those seen on the much longer journey from the tropics to the poles: rain-forest, deciduous forest, coniferous forest, grass and mountain or 'alpine' plants, and finally nothing but lichens encrusting the rocks. Successive zones of vegetation accompany changes of altitude as well as changes of latitude.

Just as there is a level on a high mountain, called the snow-line, above which snow remains all the year round, so there is a level above which trees do not grow. This is usually the highest level of the coniferous forest and is called the tree-line. It is about 11,000 to 12,000 feet at the equator and becomes lower and lower as you go north and south. In the Alps it is about 6,000 feet, in Britain 1,500 to 2,000 feet, and in the arctic regions it comes down to sea level.

Diagram showing the zoning of vegetation on the highest mountains of Europe, Asia and Africa. (In the two Americas the mountain ranges which run north to south on both continents show great variety in their vegetation according to both altitude and latitude.)



Mountain vegetation

These two pictures, and the three on the next page, show vegetation found on mountains in different parts of the world, and, as you can see, it varies tremendously.

A scene in the Alps at 5,600 feet above sea level. We are already near the tree-line, and a little higher up the trees will give place to low shrubs, grass, and herbs.

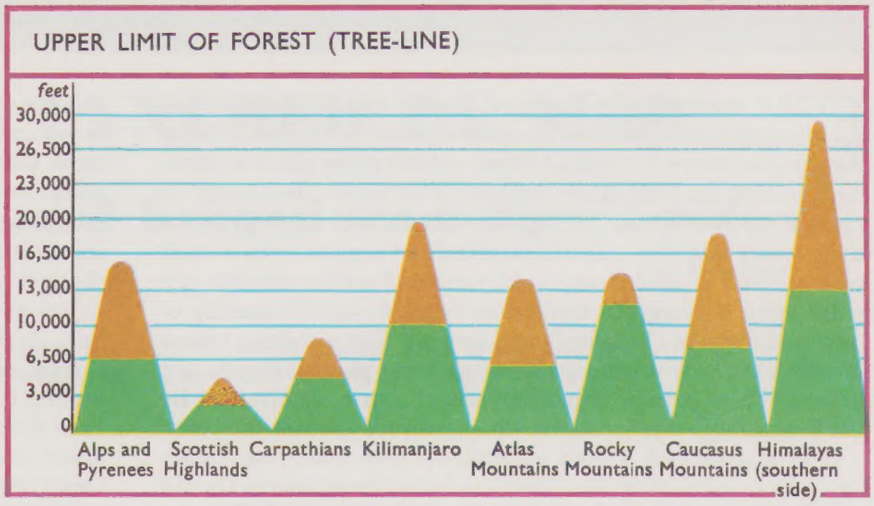
This picture shows the vegetation on a mountain in the Congo at 6,500 feet. It is of the type known as tropical rain-forest, which needs almost continuous heavy rain for its growth and is extremely dense and impenetrable.

Lower down in the same region the rainfall is insufficient to support forest, and vegetation is of the savannah type (see page 1985). *In the tropics forest grows at a level that is above the tree-line in the Alps.*

Vegetation on a plateau in Kenya at 12,200 feet. The plants shown are enormous 'herbs', sometimes over 20 feet high and related botanically to the groundsel which grows as a weed in British gardens. These plants, growing just above the tropical tree-line, give rise to some of the strangest scenery in the world.

Another of the gigantic 'herbs' which are found high up on the mountains of tropical Africa. This is a lobelia growing on Mount Ruwenzori at a height of 14,800 feet. At the same height in the Alps one would have left the tree-line far below and entered the region of perpetual ice and snow.

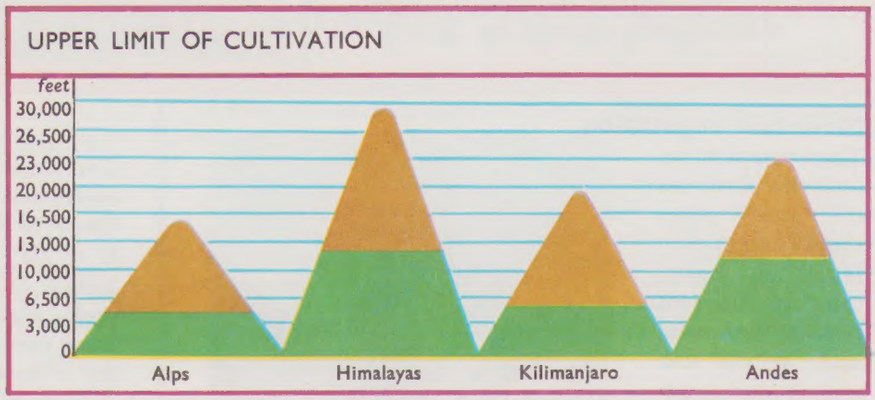
Bromelias (plants allied to the pineapple) growing at 13,000 feet in the Andes of Ecuador.

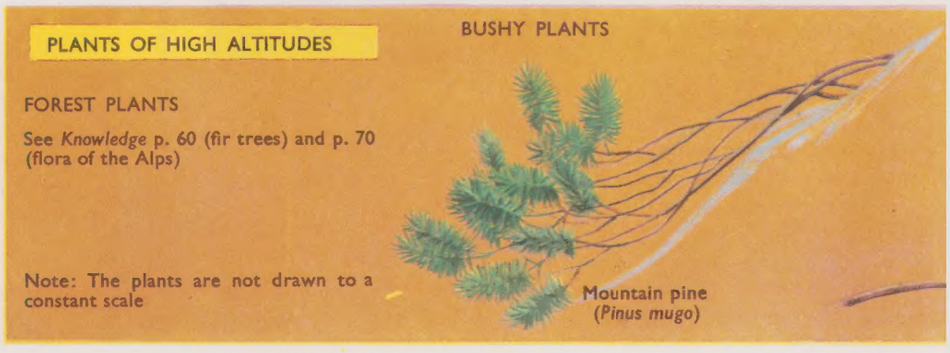


The influence of man

The vegetation of mountains is affected by man's activities, just as it is in other parts of the world. The lower slopes of the mountains, whose natural vegetation is forest, are very fertile. Here the forest is often cut down and replaced by meadows, orchards, and fields growing a variety of crops. The higher coniferous woods supply valuable timber, and these are often cut down too. Only above the tree-line does the mountain vegetation usually remain in its natural state.

The mountain fields and woods contribute a great deal to the welfare of man, but destruction of the forests can be very harmful. The natural cover of trees stops the rain from running off the slopes too quickly, and their roots hold the soil. If the trees are removed, soil erosion will take place. Deep gulleys will form and widen until all the soil is washed away and only bare rock remains. The consequent excessive deposition of mud and sand in the lowlands will cause serious flooding. Destruction of the mountain forest will also lead to extermination of all the interesting animals, birds, and insects which live in it.




PLANTS OF HIGH ALTITUDES
FOREST PLANTS
See Knowledge p. 60 (fir trees) and p. 70 (flora of the Alps)
Note: The plants are not drawn to a constant scale
BUSHY PLANTS
Mountain pine (Pinus mugo)

10,000 feet

microscopic algae on the snow and in pools of water

clusters of tiny flowers growing in crevices of rock

8,000 feet

upper limit of alpine meadows

shrubs (mountain pine, juniper)

upper limit of forest

6,500 feet

conifer forest (larch, Scots pine)

upper limit of cereals and potatoes

5,000 feet

deciduous forest

upper limit of hayfields

3,000 feet

fields of hay

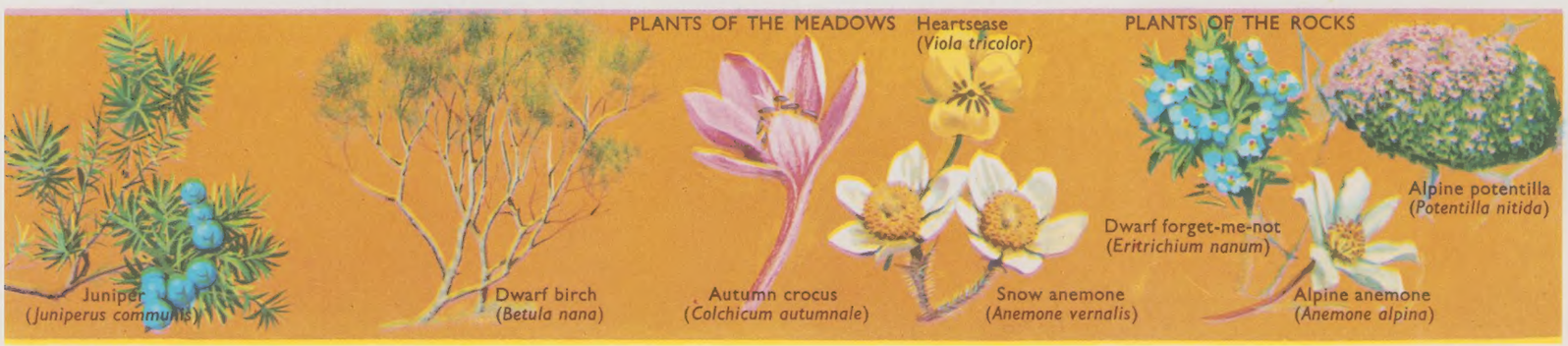
chestnut groves and orchards

vines

mixed agriculture

riverside woods

View of a south-facing alpine valley, showing the succession of plants. The vegetation has been greatly modified by man



COLOMBIA – history

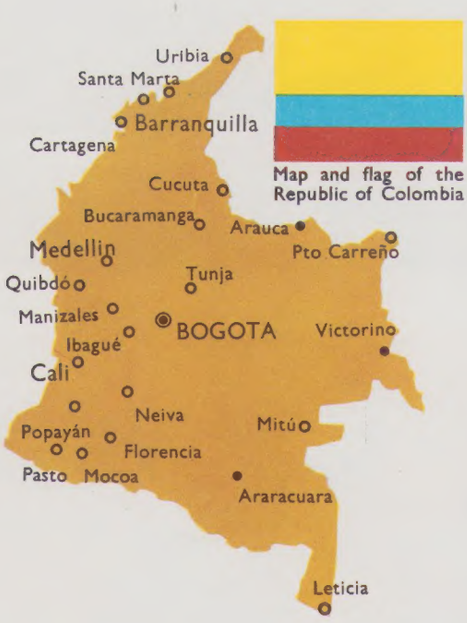
TURBULENCE, bloodshed, rival leaders grasping for personal power; all have been a part of South American history. But Colombia's history has been much freer from these evils than most South American states. Most of its internal conflicts have not been between people but between ideas: between factions with genuinely different views on how the country should be governed. In fact Colombia's history has been dominated more by parties than by personalities.

The history of modern Colombia, like that of many other South American states, begins with Simon Bolivar, who was responsible for smashing the Spanish rule in South America. In 1819 Colombia, together with Ecuador and Venezuela, formed a state known as Gran Colombia, independent of Spanish rule. After Bolivar's death in 1830 this state split up: Ecuador and Venezuela went their separate ways. Colombia now became the state of New Granada. (At the end of this article we will see what happened to Colombia's other partners in the original state of Gran Colombia.)

New Granada was more a collection of provinces than a united state. The Church had a strong hold on the views of the population, but many of the political leaders were anti-clerical and had advanced political ideas, which were very much in line with the radicalism which was prevalent in Europe at that time.

Two parties soon emerged. One, the Conservative Party, supported the Church and wanted a strong central government with a limited number of people voting to elect the government. The other, the Liberal Party, was more radical, against the Church, and in favour of strong provincial governments rather than a dominant central government.

Simon Bolivar rides in triumph into Bogota after his defeat of the Spanish



Map and flag of the Republic of Colombia

Tomas de Mosquera

But although politically advanced, Colombia was by no means a unified state. In 1855 Panama declared itself independent inside the framework of the state of New Granada. Seven other provinces followed suit, and in 1863 the central government was forced to acknowledge this, changing the name of the state to the United States of Colombia. In the 1860's one of the most remarkable characters in Colombian history came to power: Tomas de Mosquera. Although beginning his career as a Conservative, as President he carried the Liberal doctrines to their extreme. In 1867 he imprisoned the Archbishop of Bogota, confiscated the Church's property, and expelled the Jesuits. In the same year he was deposed. For nearly 20 years after this Colombia's history was one of bitter discord and chaos. But in 1886 Rafael Nuñez, a Liberal turned Conservative, changed the constitution. The Church's property was restored, and the independence of the provinces drastically curbed. Colombia now became the Republic of Colombia. The rule of the Conservatives was to last until 1930.

The Liberals also wanted to have as many people voting as possible. In fact in 1853 a Liberal government granted all adult males the right to vote; this was over 30 years before a similar suffrage was granted in Britain.

The Panama Canal

Towards the end of the 19th century the United States became extremely interested in Colombia's province of Panama, because she wished to build a canal through the isthmus. In 1903 the Hay-Herran Treaty was signed: in return for $100,000,000 and an annual rent of $250,000 a year the United States was granted the lease of a corridor of land 10 miles wide running across the Isthmus of Panama. But the Colombian senate refused to ratify this treaty. There was a successful revolt in Panama, supported by the United States. The new Panamanian government granted the United States the right to build and control the canal. The Colombian government was extremely annoyed, and this was one of the reasons for Colombia staying strictly neutral during the First World War.

The period between the wars was, on the whole, one of quiet. During the Second World War Colombia supported the Allies, breaking off diplomatic relations with Germany, Italy, and Japan. However, after the war, conflict between the two parties began again. In 1946 the Liberals returned to power, and never in Colombia's history had the two parties been involved in such bitter strife. In 1950 Gomez, an extreme Conservative, was elected President, and fighting broke out. In 1953 the army decided to put an end to Gomez's government, but the military ruler who succeeded him, Rojos Pinilla,

proved to be a tyrannical dictator and the country was no better off. In 1957 there was another military revolt and Pinilla was removed.

By this time Colombia had had enough of the continual strife between the two parties. Moreover, most responsible Colombians realised that the energy of politicians should be devoted not to quarrelling with each other but to improving the conditions of the Colombian people. In the referendum of 1957 a remarkable new constitution was agreed to by the people. The military junta who had deposed Pinilla were to remain in power until 1958, after which there was to be a National Front Government. It was agreed that a Liberal president would be in office from 1958 to 1962, a Conservative from 1962 to 1966, and so on. There would be ministers of both parties in the government. Despite splits inside the ruling party, this system of government by 'remote control' worked. The Liberal Alberto Camargo was President until 1962, when he was succeeded by Guillermo Valencia, a Conservative.

Today the Colombian government seems to be stable. Much has been done with the help of the United States to improve conditions among Colombia's poor, who are almost entirely *mestizos* (that is, people of mixed Spanish and Indian descent).

Politically, present-day Colombia supports the democratic world in its struggle against Communism, and the group of Liberals who advocate a regime similar to that of Castro in Cuba are very much in the minority.

Future stability

What of the future? The supporters of Castro may add a new element of strife, but most Colombians are confident that in 1970, when the temporary 1957 constitution comes to an end, Colombia should be stable enough to return to normal elective government.

GRAN COLOMBIA FROM 1830 UNTIL TODAY

As we have seen, in 1830 the state of Gran Colombia broke up: Ecuador and Venezuela went their separate ways. In 1903 Panama also parted company with Colombia. What happened to these countries?

Ecuador's history has not been a happy one, for much of it has been dominated by chaos or tyranny. There have occasionally been periods of statesman-like control, like that of Gabriel Moreno (assassinated 1875), but these were few and far between. As in Colombia, Liberals and Conservatives struggled for power. Between 1935 and 1940 there were no less than seven presidents or heads of state. However, the most recent governments of Ecuador have been much more constitutional and stable.

Venezuela, too, has had a particularly depressing history. Power and wealth have been in the hands of a small class who constantly struggled among themselves. The majority of rulers have been generals. Education was neglected, and until quite recently half the population was illiterate. For most of this century Venezuela has been controlled by force (see page 62).

One of the most remarkable rulers of Venezuela was Juan Gomez, who dominated the country for 27 years until his death in 1935. He amassed a colossal fortune – some say nearly £50 million. He treated the country like a royal demesne, and bought plantations and factories with public money. When this 'Tyrant of the Andes', as he was called, died, Venezuelans sacked and burned the homes of his family and supporters.

Since the 1920s great wealth has come into Venezuela from oil revenues, but it has only gone into a few pockets. Today Venezuela might be described as one of the world's richest underdeveloped countries. She is, in fact, the third largest oil producer in the world. President Betancourt, who was elected in 1959, was the first president to be democratically elected and to remain in office for more than 18 months. He has attempted to achieve a more even distribution of wealth, and to raise educational standards.

Panama continued her hostility to Colombia for some time after 1903. In fact, not until 1924 were diplomatic relations established. There was, after this, a certain amount of hostility towards the United States, but by the treaty in 1936 many Panamanian grievances were redressed.

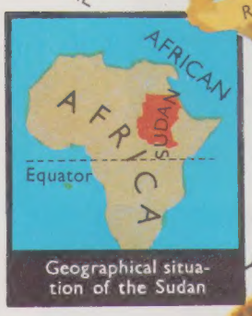
Today the Gran Colombian countries still keep a feeling of identification. In Caracas, the capital of Venezuela, there is a ceremony every year in which the original proclamation of their liberator, Simon Bolivar, is read. In this proclamation he referred to the peoples of all these territories as 'Colombians'. The Gran Colombian countries form a recognisable group in South America, having a feeling of special friendship for each other, and similar foreign policies. They are, on the whole, friendly towards the United States, and do not support President Castro of Cuba.

Map showing the states which have grown out of Gran Colombia

THE SUDAN

BELAD ES-SUDAN, the country of the blacks; this was the name given by the Arab conquerors to the land through which the White Nile flows. Here the land is overgrown with tall grasses and thick woods – the home of elephants, lions, leopards, giraffes, zebras, and many kinds of antelope. The people of this region are tall and very black, and have an extraordinary and quite inexplicable habit of standing on one leg. Most of them are pagan. They live a simple life – hunting, fishing, and herding cattle.

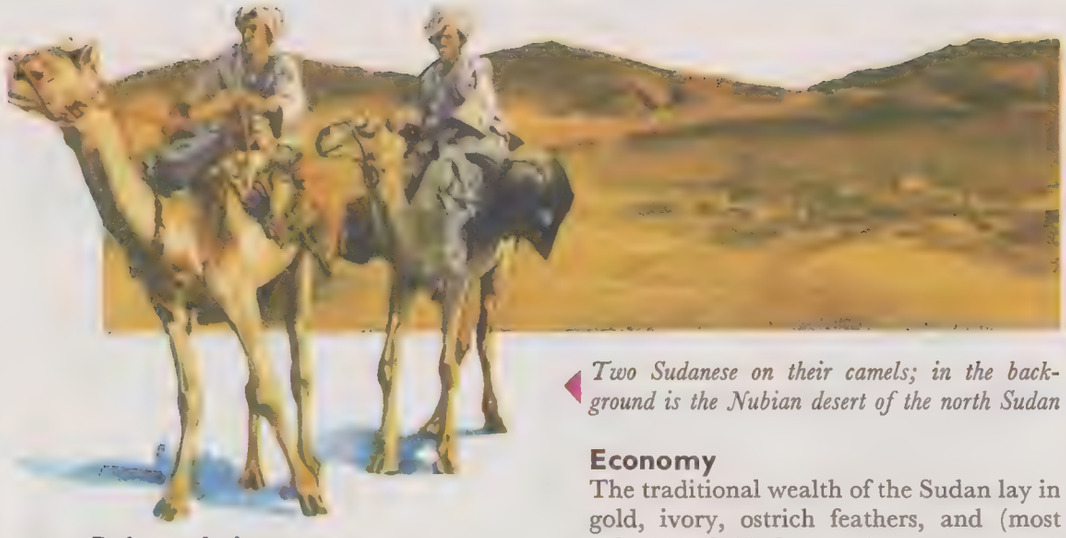
But the present Republic of the Sudan stretches far north of this area, including most of Nubia and bordering on Egypt in the north. Apart from the Nile valley, this northern part of the country is an arid desert. The people are mostly Arabic-speaking Muslims, who for many centuries have been under Egyptian influence. The Republic also reaches the Red Sea in its north-east corner. The narrow coastal plain along this shore is separated from the main part of the Sudan by a range of mountains. These mountains extend south into Ethiopia. The Republic of the Sudan covers the vast area of 967,500 square miles, but because so much of this is desert, its population is only about 12 million.



Geographical situation of the Sudan

ANIMALS OF THE SUDAN

giraffe
buffalo
zebra
ostrich
lion
dromedary
leopard



Two Sudanese on their camels; in the background is the Nubian desert of the north Sudan

Rain and rivers

The climate of the Sudan is scorchingly hot, especially in the centre. The average annual temperature at Khartoum is 80°F. Rainfall, which is only about 4 inches a year in the desert region, increases to over 40 inches as one travels south. The Sudan, like Egypt, would be almost uninhabitable were it not for the river Nile. Most of the towns are situated on its banks, and most of its agriculture is concentrated in its fertile valleys.

The two main tributaries of the Nile meet at Khartoum. They are the White Nile (known as the Bahr el Jebel), flowing northwards through the Sudan from Uganda, and the Blue Nile, which comes from Ethiopia. Between these two rivers lies the triangular plain of the fertile Gezira. Farmers there get free water, and in return must grow specified amounts of cotton, grain, and fodder. Profits are shared between the government, the farmers, and the management of the irrigation scheme.

Economy

The traditional wealth of the Sudan lay in gold, ivory, ostrich feathers, and (most valuable of all) slaves, who were captured from the southern district by men from the north and sold in exchange for manufactured goods.

Today little gold is mined, and the chief export is cotton. Grain, which used to come mainly from the Gezira, is now grown extensively in the plains round the Blue Nile and its tributaries.

The forests in the south produce mahogany, and there are large gum acacia forests; the Sudan is one of the world's largest producers of gum arabic. Large quantities of papyrus are produced in the White Nile region.

Livestock is also an important factor in the country's economy, and camels, cattle, and sheep are exported.

History in brief

Two factors have influenced the history of the Sudan greatly: its proximity to Egypt, and the river Nile. These two are themselves related, the flood waters of the Nile being so vitally necessary to Egypt that her rulers have constantly sought to gain control of the upper reaches of the river. Usually the rulers of Egypt have been the aggressors, although the ancient kingdom of Cush (part of Nubia) was powerful enough to control Egypt for about 50 years during the 8th century B C. For many centuries such powerful states in the northern Sudan were able to resist invasions, and in the 7th century A D were powerful enough to make a treaty with the Arab invaders who had conquered Egypt.

More and more Arabs settled in the northern Sudan during the following centuries, intermarrying with the original inhabitants and converting them to the religion of Islam. The Muslim tribes became powerful, but eventually quarrelling broke out between them, and in the 18th century they became disorganised and weakened by civil wars.

This gave the Turkish rulers of Egypt the opportunity they wanted. In the early 19th century they conquered the Sudan. Egyptian control was harsh and oppressive, and in 1882 the Sudanese rose up in rebellion under a religious leader known as the Mahdi. For a time the revolt was successful, and the Egyptians were thrown out, but it was not only Egypt that the Sudanese had to reckon with. The British had bought the Suez Canal shares in 1875, and were establishing control in Egypt. In 1896 a joint British and Egyptian force began to conquer the Sudan, and in 1898, commanded by General Kitchener, it inflicted a crushing defeat on the Mahdi's army of dervishes at Omdurman.

For the next 50 years the Sudan was ruled jointly by the British and the Egyptians, with effective control by the British. During this time the present boundaries of the country were established and the foundations of prosperity laid. Order was restored, and agriculture, commerce, and education improved. No great attempt was made to alter local customs, laws, religions, or languages. The south of the country, hitherto ignored except as a source of slaves, was now brought into contact with western civilisation. Long-staple cotton growing, the present basis of Sudan's economy, was introduced and financed by the British.

But after the Second World War nationalism grew in both Egypt and the Sudan, and on 1st January 1956 the Independent Republic of the Sudan came into being. Two years later the Army took over control, dissolving Parliament and political parties and suspending the constitution. Today the Sudan is governed by a military junta, with the assistance of a few civilian ministers.

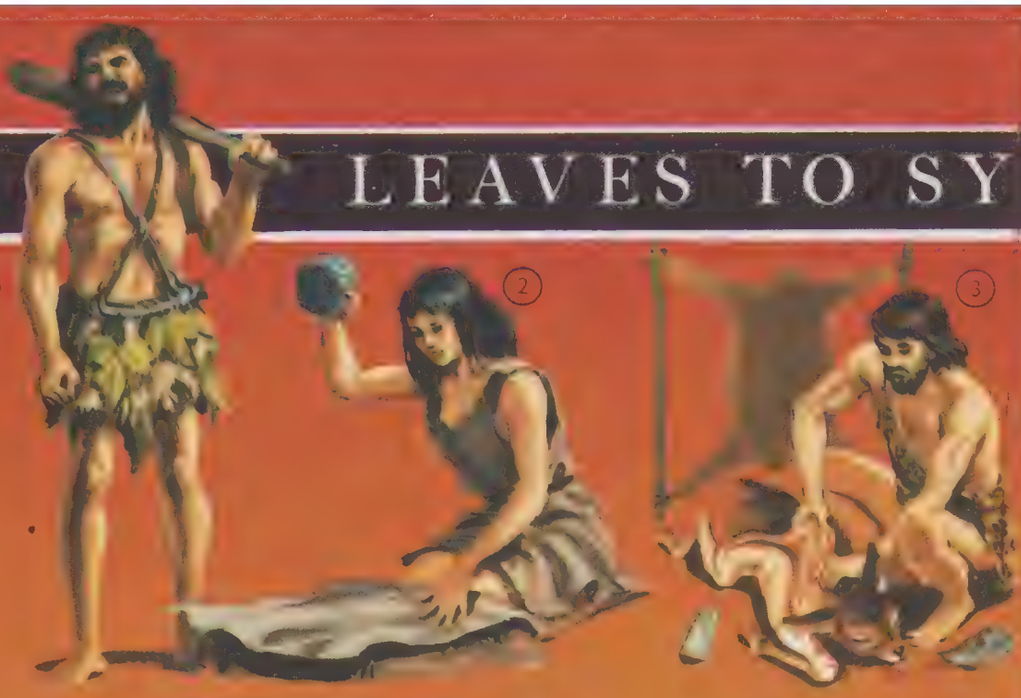
KHARTOUM, THE CAPITAL

Khartoum lies where the White Nile and the Blue Nile meet. It is made up of three cities: Khartoum itself, the seat of government; Khartoum North, an industrial suburb; and Omdurman, the Arab quarter. The total population is 312,000. Khartoum was founded in 1823 by the Egyptians, and rebuilt in 1899 by Kitchener with the street plan like a Union Jack.

FROM LEAVES TO SY

WHAT are you wearing today? If the weather is hot, you are probably wearing something made of cotton; if cold, then something made of wool. These are the two most widely used natural fibres. Cotton is one of the many vegetable fibres that come from either the fruit, leaves or stems of different plants. Wool is an animal fibre and comes from sheep; other animal fibres include camel and alpaca hair. There are few mineral fibres; asbestos, used for protection against heat and flames, is the best known, although threads are sometimes made from gold or other precious metals. To make these fibres into clothes, they are first twisted together into long threads, called yarn. The yarn is then woven into material.

But perhaps the clothes you are wearing are not made from any of these natural fibres. There is another group of fibres that have come into use during the last 60 years – synthetic or man-made fibres. There are two kinds of synthetic fibres: those made from natural substances treated with chemicals, and those made entirely from chemicals. The idea of using chemicals to make fibres is not new (it was first thought of as early as 1664), but it was not until the late 19th century that chemists produced the first viscose rayon, or 'artificial silk'. Commercial production of rayon began in England in 1904. During the last 40 years, experiments with synthetic fibres have continued and fabrics such as nylon, orlon, and terylene have been the result. Synthetic fibres now make up one-third of the world's yearly production of fibres, second only to cotton.



① The first man was probably dressed something like this. He is wearing a costume made from leaves, grasses, and the bark of a tree. Unlike modern fashions, primitive styles changed very little, and this particular one probably lasted for several thousands of years.

② We are now in the Old Stone Age. Man has become more skilful, and his clothing is more elaborate, giving greater protection and warmth. This girl is beating a strip of tree-bark with a stone to make it pliant. It will then be used as clothing.

③ In the Middle Stone Age man was an accomplished hunter. The meat of the animals he caught served as food, and the skins and hides were used for clothing. After a hunting trip, the animals (like this deer) were skinned and the hides staked out to dry.

⑪ The yarn goes from the spinning mills to the textile factory where machines weave it into materials. Towards the end of the 18th century the weaving industry was threatened with collapse because the weavers, with their hand looms, could not cope with the vast quantities of yarn produced by the spinning machines. Edmund Cartwright set himself the task of building a power loom, and in 1785 he patented it. Improvements had to be added to his machine by other inventors, and the clothing industry was given a further impetus by the development of the sewing machine in the 1840's and 1850's.

⑩ The invention of a power-driven spinning machine, by Richard Arkwright in the 1760's, made it possible to produce strong and even threads very quickly. Today, mills are equipped with rows of spinning machines like these, which need very few people to control them.

⑫ This machine makes rayon fibres by squirting the viscose (wood pulp soaked in caustic soda) through minute holes into a cooling acid bath. The fine jets quickly solidify, forming threads. The threads are then twisted into a yarn to be woven into fabrics.

NTHETIC FIBRES

④ Man learned the art of farming during the New Stone Age, and began to rear animals for food and clothing. Wool was perhaps the first fibre to be used. Before man discovered how to build a loom for weaving, he merely cut the wool off his sheep and piled it in a heap. The wool was then beaten until the strands stuck together to form a thick, matted material like felt. This was both soft and warm.

⑤ The art of weaving was discovered towards the end of the New Stone Age. Flax was probably the first fibre to be woven because the threads, which come from the stem, are very long, and do not need to be spun into strands first. This man is making a net from flax fibres.

⑥ Flax was widely used in the Western World, and the Egyptians were the first to weave it into linen. Cotton (first grown in India) is here being spun into fine threads ready for weaving. In China and the East silk was also produced.

⑨ For centuries this was the only way to spin. The fibres are pulled from the bundle on the distaff, twisted together into a continuous thread and wound on to the spindle. The yarn spun in this fashion was of uneven thickness and often broke easily.

⑧ This scene from a Greek legend was painted on a vase. It shows Penelope sitting before her loom and dreaming of the return of Odysseus, her husband. This is the simplest kind of hand loom, with small stones or clay weights holding the warp (the threads hanging downwards). The shuttle holding the yarn was moved to and fro by hand, forming the weft.

⑦ This Mexican is cutting leaves from an agave plant. These leaves are dried and beaten, and their strong fibres, known as sisal, can be plaited or woven to make mats, ropes, cloth, and even roofing material. Other strong leaf fibres are manila hemp and raffia.

THE CAUCASUS

THE moon shines brightly from a starry, cloudless sky, making a yellow carpet across the blackness of the sea. Suddenly the tranquil beauty of the scene is shattered as a warship slides from the dimness of the shadows into the glare of the moonlight, and, as searchlights flash across the Black Sea, armoured cars rumble along the shore.

Day in, day out, this Communist vigil is maintained to prevent Russian refugees trying to escape to the West. For the Caucasian region, bordering both the Black and Caspian Seas, links the Soviet Union with Turkey and Iran. It forms a close if precarious escape route to the outside world.

All along this border Soviet guards keep watch. But behind this unwelcome glimpse of cold war conflict lies one of the most fascinating and old-fashioned regions of Russia; a land of snow-capped mountains and valley lowlands – of thick forests and rich steppe lands; southerly and warm, populated by over 40 national groups speaking a score of different languages; the Caucasus.

The geographical position of the Caucasus

The Caucasus lies between the Black Sea and the Caspian Sea. It is a broad isthmus of mountainous land which connects European Russia with Asia Minor.

A view of the central part of the main range of the Caucasus and the summit of Elbruz, an old volcano; altitude 18,481 *feet*

Running right across the Caucasus, from north-west to south-east, is the Great Caucasian mountain range. It is generally accepted as the natural boundary between Europe and Asia. It is over 750 miles long and varies between 30 miles and 140 miles in width. Much of the range is quite young as mountains go and was folded into its present shape by the same great earth movements which produced the Alps in northern Europe and the Himalayas in Asia. In these mountains live many wild animals, including brown bears, ibex, chamois, lynx, jackals, and – surprisingly – leopards.

The Caucasus falls into three natural divisions: the *Pre-Caucasus* with its plains and foothills; the *Great Caucasus*, which includes the highest mountains; and the *Transcaucasus*, which lies south of the main mountain range and borders on Turkey and Iran.

The Pre-Caucasus

The northern part of the isthmus, the Pre-Caucasus, is really a continuation of the great East European Plain. It has much the same climatic conditions as the Ukraine, and shares the

severe winter weather of central Russia. In the west, near the Black Sea and the start of the mountains, the soil is rich and dark and the climate is wet; this has made it one of the most important cereal-growing areas in the whole of the Soviet Union. The chief crops are wheat and maize, but rice has now been introduced in the swamps along the Kuban river, and other new crops like cotton, soya beans, and castor oil plants are also being grown.

The east of the Pre-Caucasus is drier and not nearly so fertile as the west. The plains here are chiefly used for grazing – of cattle, horses, and above all of sheep.

It is natural that many of the industries of such a rich agricultural region are based on the processing of agricultural raw materials. But there is also heavy industry, based upon the oil and natural gas which are found near Grozny and Makhachkala in the east, and between Krasnodar and Novorossiysk in the west. The rivers flowing northwards from the mountains have been harnessed to provide hydro-electric power.

extensive snow cover of the high peaks. The massif of Dykh-tau and Kostan-tau is visible

The Great Caucasus

This central region of the isthmus is the most mountainous area, with a number of parallel ranges running from north-west to south-east, intersected occasionally by others running across the main trend. The mountains are highest in the centre, and Mount Elbruz, which reaches a height of 18,481 feet, is sometimes called the highest mountain in Europe (though whether it should be considered as lying in Europe or Asia is a controversial point).

The main ranges rise fairly gently from the foothills in the north, but fall sharply away towards the south. In the west the mountains are covered with luxuriant forests, with many common European trees and shrubs, including rhododendrons, but the eastern mountains are drier and generally treeless.

The height of the snow line varies between 8,000 feet in the west and 11,700 feet in drier eastern areas, and there are many glaciers. Almost all the large rivers of Caucasia have their sources in these mountains.

Transcaucasia

Transcaucasia is also a mountainous region, but it lies to the south of the main ranges. Only about one-third of the total area lies below 2,000 feet. The uplands are made up of folded mountains and plateaux scored by deep gullies.

The main mountains to the north of Transcaucasia form a barrier to air movement, and so the climate of Transcaucasia is very different to that of the northern part of the isthmus. In particular, the mountains shield the area from the cold winter air masses coming from central Russia and Siberia. In the west, the coastal lowland fringing the Black Sea is exceptionally mild, and crops like citrus fruits, tea, tobacco, and grapes can be grown there.

Transcaucasia is rich in minerals, and the oil field at Baku on the Caspian Sea is one of the most important in the world. The mountains provide iron, manganese, and other minerals, and, as in the Pre-Caucasus, the rivers provide hydro-electric power. Transcaucasia is now important industrially.

The peoples

Since ancient times the Caucasus has provided a valuable land-bridge between Europe and Asia, and different empires have fought to gain control of it. The Greeks established colonies on the shores of the Black Sea, and Alexander the Great occupied the Caucasus on his way to India. The history of the region is one of repeated invasion and conquest by Arabs, Turks, Persians, and Tartars. It is not surprising that these human tidal waves which swept across the region have left behind them a population consisting of more than 40 different national groups.

Towns

The three largest towns in the Caucasus are Rostov, Tbilisi, and Baku, each of which has a population of over half a million.

Baku, the centre of the most important oil-producing region, is the chief port on the Caspian Sea. Tbilisi is the capital of the Georgian Republic and is an extremely old town. It is now one of the most important industrial centres of Transcaucasia. Rostov, which is to the north of the area shown by the map, is the administrative centre for the Pre-Caucasus. It lies between the rich agricultural areas of the Ukraine and Pre-Caucasus, close to the important industrial region of the Donetz valley. It is a port and is connected with the Black Sea by the Sea of Azov.

Along the Black Sea coast there are a number of well-known health and pleasure resorts, such as Sochi. This coast is sometimes called the 'Soviet Riviera'. The climate is of the Mediterranean type and the entire coast is one of the favourite holiday areas of the Soviet people.

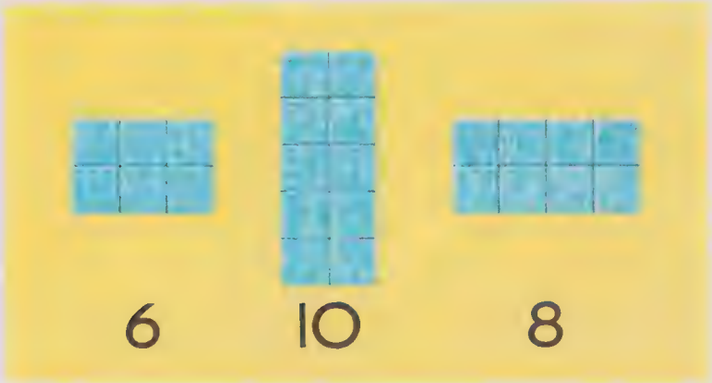
Communications

Because the main ranges of the Caucasus lie right across the isthmus, the main lines of communication follow the two coastlines or run from east to west along the northern and southern sides of the mountains. Only one main road crosses the mountains themselves.

A small village in a Caucasian valley

PRIME NUMBERS

AS we have seen in our article on number patterns (see page 2108), numbers have associated geometrical patterns. Some, for instance, have a related rectangular form, like 6, 10, and 8, as illustrated below.



Those that have this rectangular form are always expressible as products of any two numbers. So $6 = 3 \times 2$; $10 = 2 \times 5$; and $8 = 4 \times 2$.

The numbers which cannot be represented by rectangles are referred to as *prime numbers*. For instance, 11, 31, 79, and 101 are examples of prime numbers, and as they cannot be represented by a rectangle they are never products of two numbers. They have no divisors other than themselves and one.

Eratosthenes, a Greek mathematician and a friend of Archimedes, devised a method for obtaining prime numbers in their numerical order. This method is known as the *Sieve of Eratosthenes*.

Here are the principles on which it works:

Look at the list of figures below:

1 2 3 ~~4~~ 5 ~~6~~ 7 ~~8~~ 9 ~~10~~ 11 ~~12~~ 13 ~~14~~
15 ~~16~~ 17 ~~18~~ 19 ~~20~~ 21 ~~22~~ 23 ~~24~~ 25

You will see that all the multiples of 2 are crossed out. Now look at the next list:

1 2 3 ~~4~~ 5 ~~6~~ 7 ~~8~~ ~~9~~ ~~10~~ 11 ~~12~~ 13 ~~14~~
~~15~~ ~~16~~ 17 ~~18~~ 19 ~~20~~ ~~21~~ ~~22~~ 23 ~~24~~ 25

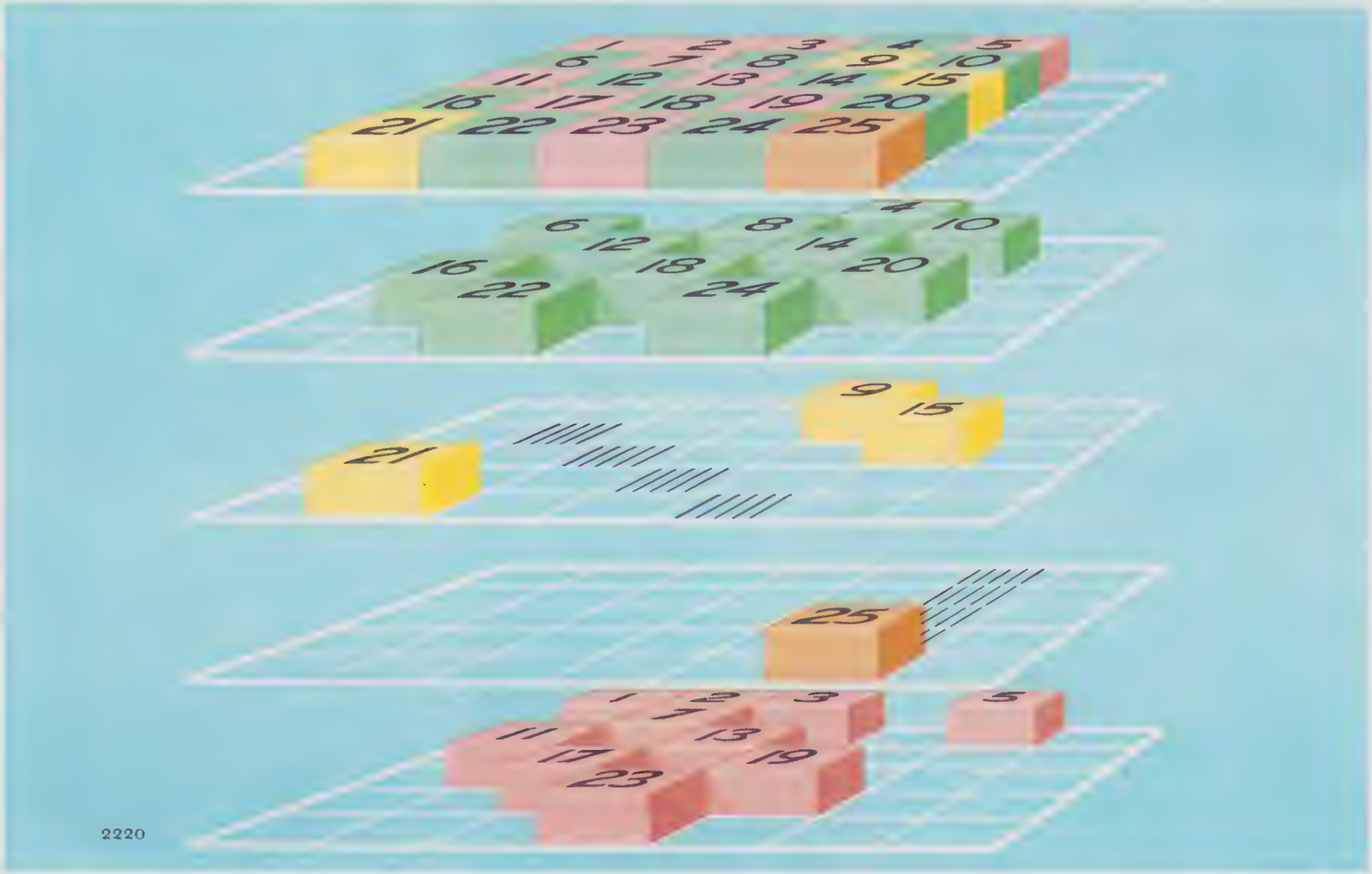
You will see that all the multiples of 3 are crossed out, together with the multiples of 2.

Now look at the list below and you will see that all the multiples of 2, 3, and 5 are crossed out:

1 2 3 ~~4~~ 5 ~~6~~ 7 ~~8~~ ~~9~~ ~~10~~ 11 ~~12~~ 13 ~~14~~
~~15~~ ~~16~~ 17 ~~18~~ 19 ~~20~~ ~~21~~ ~~22~~ 23 ~~24~~ ~~25~~

The numbers which remain are called prime numbers. These are 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, and so on.

Now look at the drawing of the sieve. Imagine that all the numbers from 1 to 25 are being dropped through the sieve. All these numbers drop through the top rack, but on the second those which are multiples of 2 are caught. These are coloured green.



On the third rack all the numbers which are multiples of 3 are caught, except, of course, those which have already been caught as multiples of two. These are coloured yellow. In the fourth rack 25 is caught – this is the only multiple of 5 which is neither a multiple of 3 nor a multiple of 2. It is coloured orange.

The numbers that get through to the final rack are prime numbers.

You will see that there are black squares on the sieve. In the third rack these show where the multiples of 3 would have been caught if they had not been caught by the rack above. The black squares in the fourth rack show where the multiples of 5 would have been caught had they not been caught by the two racks above.

You may also wonder why there is no rack taking out multiples of 4. This is because 4 is a multiple of 2, and therefore all multiples of 4 are also multiples of 2.

Formulae for primes

This 'sieve' method of producing prime numbers is laborious, and mathematicians have long been searching for a simple method of producing them, without success.

The expression n^2-n+41 might appear to be a possible formula for prime numbers.

When $n=1$ the expression $=41$ which is prime
,, $n=2$,, $=43$,,
,, $n=3$,, $=47$,,
,, $n=4$,, $=53$,,
and so on.
But it breaks down when $n=41$. Can you see why?

Fermat, a 17th-century French mathematician, thought that he had found a formula for prime numbers: $2^{2^n}+1$

When $n=1$ the expression $=5\ (2^2+1)$
,, $n=2$,, $=17\ (2^4+1)$
,, $n=3$,, $=257\ (2^8+1)$
,, $n=4$,, $=65{,}537\ (2^{16}+1)$
,, $n=5$,, $=4{,}294{,}967{,}297\ (2^{32}+1)$

However, another mathematician, Euler, showed that the last number is not prime but is, in fact, $641 \times 6{,}700{,}417$.

Largest prime known

As you can imagine, it takes a long time to decide whether any number is prime, and, up to date, the largest one known is $2^{3217}-1$, which, when worked out, has 969 digits. The testing in this case was done in an electric computer.

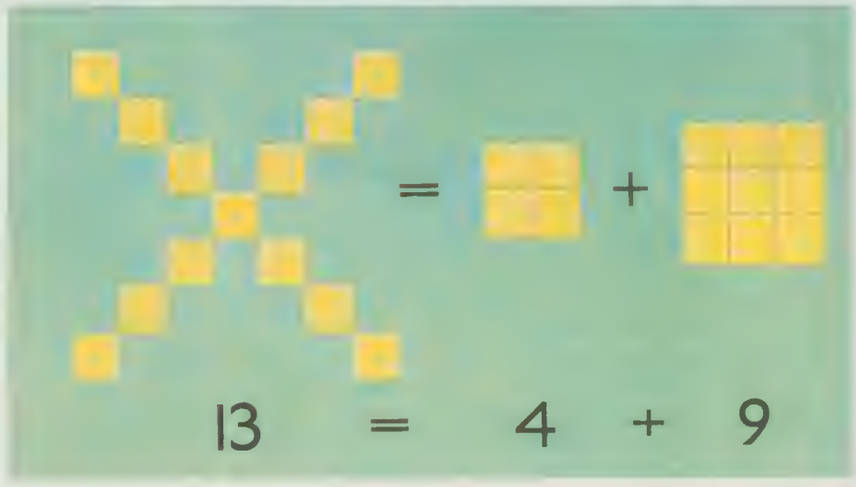
Number of primes

One may wonder whether the primes go on for ever or whether there is in fact one number which is the largest prime number. Euclid, by a very neat argument, proved that there are an unlimited number of primes.

Suppose, he said, that the largest prime number you have found is p. Multiply all the previous prime numbers including p together and add 1. If the result is a prime number, it is, naturally, a larger prime than p.

If not, it must have divisors none of which can be one of the original primes since they all leave a remainder 1 on division. The divisors of the new number, then, must be prime numbers greater than p.

So in either case there is a prime number greater than p, and this process can be continued for ever.



Properties of primes

Prime numbers have many interesting properties. For instance, those which have a starred pattern, similar to the one frequently used to denote 5, can always be expressed as the sum of two square numbers.

Check for yourself that this is always so.

There are some very simple properties of prime numbers which have not yet been proved.

A famous example, known as 'Goldback's Conjecture', is that any even number can be expressed as the sum of two primes:

$12=5+7$
$20=17+3$
$34=17+17$ and so on.

Nobody has, so far, been able to find out why this should be so, and yet no one has found an even number which cannot be split into two primes.

It has also been proposed that there are an infinite number of so-called *prime pairs* which are prime numbers differing by two. (11, 13), (29, 31) are cases, but again no one has yet established whether this is so.

JOHN DRYDEN

To 'dish the Whigs' a King employed his aid,
Which Dryden gave as soon as he was paid

IT was a dark December night. The year was 1679. The most famous poet in England was on his way home to Gerard Street in London's West End. Suddenly, as he turned into Rose Alley, several tough-looking men leaped out in front of him. 'That's 'im,' shouted one, and they set upon him and beat him, battered and bleeding, to the ground.

What had John Dryden, Poet Laureate, done to deserve such treatment? The toughs were hired by Lord Rochester who thought that Dryden had written certain verses in an *Essay on Satire* which made fun of him and his 'want of wit'. In this case, curiously enough, Dryden was almost certainly innocent, for someone else had probably written the scornful verses. But this beating-up was typical of the violent feelings which Dryden's verses aroused in those who were humiliated by them.

Of Lord Shaftesbury, one of the leading politicians of the day, Dryden once wrote:

'Bart'ring his venal wit for sums of gold,
He cast himself into the saint-like mould;
Groan'd, sigh'd, and pray'd, while godliness was gain,
The loudest bagpipe of the squeaking train.'

Today poets do not make personal attacks of this kind on modern statesmen. But in the 17th century people used poetry as a vehicle for propaganda to criticise and ridicule their political opponents, and it was in this sphere that Dryden gained considerable power as well as fame.

Politics in Dryden's age were turbulent and vicious. Charles II was restored to the throne in 1660 when Dryden was 29. The Restoration followed the Puritan rule of Oliver Cromwell, and with it came a return to all the pageantry and splendour which Cromwell had done away with. Under Charles the Arts flourished, whereas Cromwell had condemned poetry and closed down theatres. Yet behind all the gaiety of the Restoration there was a Puritan movement in opposition to the King and his *Court Party*. This was the *Country Party*, led by Shaftesbury. The members of the Court Party, which Dryden supported, became known as the Tories. The members of the Country Party, whose propaganda poet was a man called Thomas Shadwell, became known as the Whigs.

Winds of change

It is surprising that Dryden became a Tory, because he came from a staunch Puritan home. Born in 1631, he was the eldest of a family of 14. He went to Westminster School and then to Trinity College, Cambridge, where he took his BA degree in 1654.

Dryden's first job was a secretarial one with Cromwell's government. He admired the Protector and wrote an effusive poem on his death in 1659. But he soon transferred his allegiance to the new King, and in 1660 wrote another poem welcoming the Restoration. He followed this with more poems in praise of the monarchy, and he also extolled Britain's war-effort against her Dutch enemies. In 1668 he was created Poet Laureate, and in 1670 became Historiographer Royal.

Meanwhile, in 1663, he had married Lady Elizabeth Howard, who was to outlive him by 14 years. Little is known of their life together, although there were stories that it was desperately miserable. Some people even said that Dryden only married her because she hired a gang of thugs and threatened to beat him up if he did not!

Dryden versus the Whigs

Dryden soon became involved in politics and wrote several poems attacking the Whigs, including *MacFlecknoe* and *The Medal*, and he, in turn, was attacked in verse by Shadwell. Dryden's most famous poem, and indeed the greatest political satire in the English language, was the brilliant *Absalom and Achitophel*, which was published in 1681. It is likely that King Charles himself paid Dryden to write this poem which uses Old Testament characters to cloak the ridicule poured on King Charles's political enemies, the Whigs. Absalom is Charles II's 'Whig' son, the Duke of Monmouth, and Achitophel is Shaftesbury himself.

Here are some examples of the way he treated his victims in *Absalom and Achitophel*. Of Lord Shaftesbury:

'Of these the false Achitophel was first;
A name to all succeeding ages curst:
For close designs and crooked counsels fit;
Sagacious, bold, and turbulent of wit.'

Of the Duke of Buckingham:

'Stiff in opinions, always in the wrong;
Was everything by starts and nothing long;
But, in the course of one revolving moon,
Was chymist, fiddler, statesman, and buffoon.'

Of Bethel, Sheriff of London:

'. . . Whose youth did early promise bring,
Of zeal to God and hatred to his king;
Did wisely from expensive sins refrain,
And never broke the Sabbath but for gain . . .
During his office treason was no crime;
The sons of Belial had a glorious time.'

Of Shadwell:

'Round as a globe, and liquor'd ev'ry chink,
Goodly and great he sails behind his link.
With all his bulk there is nothing lost in Og
For every inch that is not fool is rogue.'

Apart from his poems, Dryden wrote 28 plays, including the well-known *All for Love* and *Marriage à la Mode*. But he did not enjoy play-writing and regarded it simply as a way to make money. He also wrote many fine essays on literary criticism, and both his plays and verses are stamped with a characteristic vigour and clarity. His greatest literary achievement was perhaps the perfection of the rhyming heroic couplet which was adopted by subsequent poets and playwrights. (All the examples of his work we have quoted are in heroic couplets.)

Dryden became converted to Roman Catholicism in 1685, and wrote a number of deeply religious poems. But when the Roman Catholic James II was replaced in 1688 by the Protestants William and Mary, he lost his offices, including the title Poet Laureate, to his enemy Shadwell. He lost a great deal of his income and was a poor man when he died in 1700.

THEMISTOCLES

'THE Athenians will defend their city with a wooden wall.' So said the Delphic oracle in 480 B C, when Athens was threatened by Xerxes, King of Persia. But why a wooden wall?

Themistocles gave the answer. 'By the wooden wall the god means our ships,' he said; 'it is by them that we shall conquer.'

Events proved him right. Led by Themistocles and the Council of the Areopagus (see page 512), the Athenians took to the sea and defeated the Persians at Salamis. This momentous decision was perhaps the highlight of the career of one of the greatest statesmen in Greek history.

Themistocles first came to power in 493 B C. He at once laid the foundation of Athenian naval strength by fortifying the Piraeus. Although out of sight of the Acropolis, the Piraeus was a much finer natural harbour than the unprotected open beach at Phaleron which the Athenians had used until then. Themistocles realised that Athens could become the strongest naval power in Greece. He also realised that Greece would need a powerful fleet when the expected clash came with the Persians.

The first blow was struck within three years. The Athenians defeated the Persians in 490 B C at the battle of Marathon, where Themistocles fought as a private soldier.

But Marathon was obviously only the prelude to a greater attack. While the Persians were making menacing preparations for this, a rich vein of silver was struck in the Athenian state-owned silver mines at Laurium. Some Athenians proposed that this wealth should be distributed among the citizens; but Themistocles persuaded them instead to use it to build 100 triremes (ships with three banks of oars). These, he said, 'would be useful in the war against the neighbouring island of Aegina'; but they proved to be even more useful against the Persians.

Xerxes invades Greece

The Persian invasion came in 480 B C. Xerxes' total forces were said to be more than 5,000,000: a modern historian has estimated the numbers at around 500,000. The Persian army was certainly too big to be shipped across the Aegean, and so had to march to Greece along the coasts of Thrace and Thessaly. It was also too big to live off the country for very long; its supply route by land was rocky and dangerous; it therefore had to be supplied by sea. So the Persian navy advanced along the coast, keeping pace with the army. But if the Greeks could decisively defeat the Persian fleet, the Persian army would be compelled to retreat.

In face of their common danger, the Greek states made an alliance under the leadership of Sparta. After a gallant but unsuccessful attempt to hold the Persians at Thermopylae and engage their fleet at Artemisium, the Greeks were forced to withdraw to the Isthmus of Corinth. This meant abandoning Athens; but if Xerxes' army was to reach the Isthmus in safety, his fleet would have to defeat the Greek fleet anchored off the island of Salamis in the Bay of Eleusis.

The Athenian statesman Themistocles (514–449 B C)

The Greek naval commander was a Spartan, Eurybiades; but thanks to Themistocles's foresight the Athenian contingent was by far the largest. Themistocles urged that here was the place to defeat the Persians; and when other Greeks were considering withdrawing to the Isthmus, he secretly sent Sicinnus, a trusted slave, to the Persian commander. 'Tell him,' he said, 'that the Greeks intend to sail away during the night, and that Themistocles and the Athenians will desert to the Persians.' The Persians fell into this trap. They sent a squadron of ships to block the western end of the island. Thus they ensured that the battle would take place at Salamis, just as Themistocles wanted. Next morning they advanced to attack the Greeks in the narrow waters between Salamis and the mainland. Themistocles had enticed them into the one place where their superior numbers would be of no advantage to them.

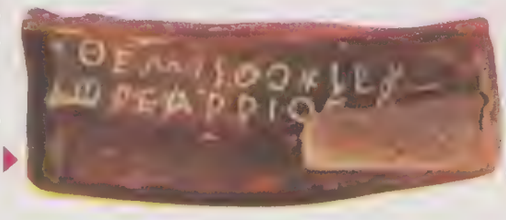
Xerxes watched the battle from a throne set up on Mount Aegaleos. Both sides fought bravely; but the Persians were defeated. Consequently their army had to withdraw from Greece. (They returned in smaller numbers the next year, but were finally defeated at Plataea.) Themistocles tried to persuade the Greeks to sail at once to the Hellespont (Dardanelles) to cut off Xerxes' retreat into Asia. Being unsuccessful, he again sent Sicinnus to Xerxes, claiming that he had *dissuaded* the Greeks from attacking the Hellespont.

Rebuilding the walls of Athens

Alarmed at Athens' new naval power, Sparta wanted to prevent her rebuilding her walls. Themistocles at once went to reassure Sparta; other ambassadors were to follow. Meanwhile rebuilding began with all speed. First he told the Spartans that he had to await his colleagues' arrival, then he suggested they sent envoys to see for themselves. These the Athenians held as hostages. When the walls were high enough to defend, the Athenian ambassadors arrived at Sparta, and Themistocles revealed the truth. To redeem their own envoys, the Spartans had to let Themistocles and his colleagues go free.

But eventually the Athenians thought Themistocles was becoming too powerful, so he was 'ostracised'. This meant banishment for ten years, by a vote of at least 6,000 citizens, who wrote the name of the person to be banished on an *ostrakon* (piece of pottery).

It then became known that he was implicated in anti-Spartan intrigues with the Persians. Sparta was then friendly with Athens and demanded his arrest. He made an exciting escape to Persia, where he successfully claimed Persian gratitude for his 'services' to them in the Persian Wars! He ended his days in comfort as Persian governor of Magnesia, in Asia Minor.



An 'ostrakon' found in Athens. Clearly inscribed 'Themistocles Phrearrios' (his legal name), it may have been used at Themistocles's 'ostracism'

JAMES MONROE

'I HAVE called the New World into existence to redress the balance of the old.' When George Canning, the British Foreign Minister, boastfully addressed the House of Commons in 1826 he claimed to have weakened 'Old World' Spain by recognising the independence of those colonies in South America which had revolted against Spanish rule.

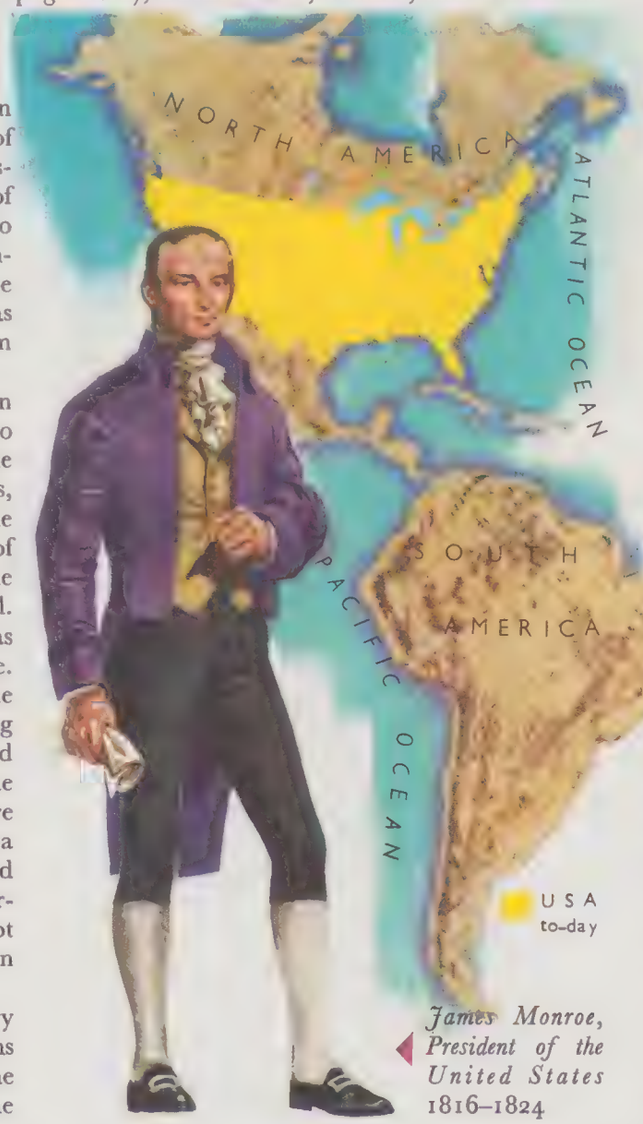
But Canning was not the first to take this step, and indeed the New World was already very much in existence. Three years earlier the fifth President of the United States, James Monroe, had made an astonishing declaration in which he denounced any form of European interference in the affairs of the entire American continent. And he had recognised the independence of Gran Colombia (see page 2212), Buenos Aires, Mexico, and Chile from their Spanish masters.

From rebel to President

James Monroe was born in Virginia on 28th April 1758. His father was of Scottish and his mother of Welsh descent. He went to college at the age of 16, but in 1776 he joined the army to take part in the struggle for independence which had broken out against the British. Thus at an early age he was fighting to remove the foreigner from American soil.

The War of Independence ended in the defeat of the British, and in 1780 Monroe began to study law under the future President of the United States, Thomas Jefferson. Two years later he was elected to the Virginian House of Delegates, and at the age of 24 became a member of the Governor's Council. In 1790 he entered national politics as a member of the United States Senate.

Monroe held many posts in the United States government, including those of minister to both France and Great Britain. Above all he became the chief negotiator in attempts to acquire the territories of Louisiana and Florida from the governments of France and Spain respectively. Louisiana was purchased in 1803, but Florida did not become finally independent of Spain until 1821.



James Monroe, President of the United States 1816–1824

At the beginning of the 19th century many foreign countries had possessions in both North and South America. The British had been thrown out of the United States during the War of Independence, but they were firmly entrenched in Canada. Both Spain and Portugal had possessions in South America, while Spain, as we have seen, also owned Florida. Louisiana belonged to France.

Even Russia was threatening to establish a colony in the extreme north-west of America.

James Monroe quickly became an acknowledged leader in the fight to prevent America from becoming a pawn in European politics.

In 1811 he became Secretary of State, which made him responsible for foreign affairs, and in 1814, when war broke out between the United States and Great Britain, he became Secretary for War. In 1816 he was elected to the Presidency of the United States, and four years later was re-elected with every electoral vote except one cast in his favour. That one vote was cast for his opponent in order to preserve for George Washington the honour of being the only unanimously elected President.

After his retirement from the Presidency in 1824, Monroe's later years were marred by growing poverty. He was compelled to ask the government for a grant to help him settle his debts. He died, appropriately enough, on Independence Day, 4th July 1831.

Go home, Europeans!

On 2nd December 1823 James Monroe made the famous declaration since known as the Monroe Doctrine. This declaration applied the principles of independence from European colonisation and interference not only to the United States but to the entire continent of America. The message ran: 'We owe it therefore to candour and to the amicable relations existing between the United States and those powers to declare that we should consider any attempt on their part to extend their system to any portion of this hemisphere as dangerous to our peace and safety.'

Apart from the compromise reached over the British Colony of Canada (see page 1622), the Monroe Doctrine has been a guiding influence in the policy of the United States for well over 100 years. It meant that the government of the United States would regard any attempt by foreign powers to acquire influence or possessions anywhere in America as a threat to herself; and she would oppose that threat. It did *not* mean that the United States considered she had a 'protectorate' over the other independent countries of America.

This has always been carefully stressed by United States Presidents. When the United States opposed French intervention in Mexico in 1867, she made it clear that once the French were out there would be no more United States interference in that country.

But this high-principled doctrine had its dangers. It resulted in the United States' isolation from Europe in the 1920s and '30s, for if the United States forbade Europeans to interfere in the Americas, she herself had no right to interfere in Europe.

When the United States forced the Soviet Union to dismantle her missile bases in Cuba in 1962 it was with the Doctrine of James Monroe very much in mind.

Second prize of £15 *in the under* 11 *age group went to:*
Beckett Park School, Foxcroft Close, Leeds 6.

VICTORY AT LAST!

WELLINGTON TRIUMPHS AT WATERLOO.

50,000 FRENCHMEN DEAD OR DISABLED.

FOLLOWING HIS VICTORY ON FRIDAY AT LES QUATRE BRAS WELLINGTON DREW UP HIS TROOPS ACROSS THIS ROAD TO BARRICADE HILL A PLACE CALLED WATERLOO.

From our War Correspondent at the Front.
Sunday, June 18th.

Today Napoleon determined to give battle to Wellington. He had a force of less than 70,000 men, with 246pieces of artillery, while the British amounted to but 74,000 men, with not more than 150 pieces. The position which Field Marshal the Duke of Wellington occupied was in front of the hamlet of Mont St. Jean, about a mile and a half in advance of the village of Waterloo. The whole line was formed on a gentle slope, its flanks partially secured by small hollows and broken ground. The two points of greatest importance in the British line, were the farm-house of La Haye Sainte, in front of the left centre, which was held by a Hanoverian battalion; and the Chateau of Hougoumont, with its wood and garden in advance of the right centre which was held by part of the guards and some companies of Nassau fifteners.

KEY TO POSITION.

Wellington considered this to be the key to his position, and great attention was bestowed upon its defence. Shortly before eleven o'clock, the enemy's columns were put in motion against Hougoumont, and the battle began. Comprising three divisions, nearly 30,000 strong, the French attack was made in close columns, supported by the fire of numerous batteries. As the heads of the enemy's masses rose above the hollow ground, which has hitherto concealed their movements, the British artillery opened with round and case shot; and the infantry and Nassau light troops, commenced a sharp and rapid fusillade. But the latter was forced to yield to numbers, - the wood was carried - and the Chateau and its dependences were vigorously and resolutely assaulted; but the defence was as able as it was obstinate.

RAPID FIRE OF ENGLISH

The fire of the English musketry fell on the French masses with rapid precision. The French gave ground - the guards charged from the enclosures - part of the wood was recovered - and the fire of the British bowitzers cleared the remainder of it from the enemy. The French attacks were renewed again and again against Hougoumont, but they were as unavailing as they had proved before; every new effort of the enemy increased the slaughter, but failed to break either the spirit or the obstinate defence. At length the French artillery opened with shells upon the house; - the old tower of Hougoumont was quickly in a blaze; - the fire reached the chapel, and many of the wounded, both English and French, perished miserably; but still the guards nobly held the place, and Hougoumont remained untaken.

ASSAULT UPON THE CHATEAU

The assault upon Hougoumont was accompanied by heavy fire from more than two hundred pieces of artillery upon the whole British line. The obstinacy with which Napoleon endeavoured to win this important post, may be best estimated by the terrible expenditure of life his repeated attacks occasioned. 10,000 men were killed and wounded in the attempts. While these terrible attacks continued against the right centre, the left of the allied position was also furiously assailed. One success only crowned the incessant efforts of Napoleon - the temporary possession of the farm house of La Haye Sainte, which was surrendered after a heroic defence of two hours. The continued attacks of the enemy on all points was exhausting the strength of the allied army and making the situation every moment more critical. Though masses of the enemy had fallen, thousands came on anew.

Plan of the Battle.

RENEW ADVANCE IN WAVES.

Many battalions of the British were cleverly formed. The loss of the individual regiments was prodigious. One, the 27th, of 40% men spread down in squares without drawing a trigger. Another, the 92nd, whose roll 800 men were left, rushed into a French column and routed it with they bayonet; a third, the 73rd, when nearly annihilated, went to require support; none could be given, and the commanding officer was told that he must 'stand or fall where he was'.

The Charge of the Royal Scots Greys.

Thus the battle raged until evening came, and yet no crisis. Wellington as he viewed the diminished numbers of his brave battalions, still presenting the same fearless attitude that they had once when the battle opened, felt that to human endurance there is a limit, and turned his glass repeatedly to that direction from which his expected support must come.

APPROACH OF BLUCHER.

At last the welcome sound of distant artillery was heard in the direction of St. Lambert, and a staff officer reported that Blucher was approaching the scene of action. This was about seven in the evening. The enemy made a desperate effort with cavalry and infantry, supported by the fire of artillery, to force the left centre of the British near the farm of La Haye Sainte. The Imperial guard, in close column, came on to the assault and ascended the slope of the position, although the fire of the English guns ascended upon their dense masses with fulsome precision.

GUARDS FACE TO FACE

Presently the guards moved forward to the crest of the height; and the finest infantry in the world confronted each other at the distance of fifty paces. The standing fire of the British guards disorganised the French column, and the latter was rapidly and steadily sustained. The shattered column of the enemy staggered down the hill with precipitate confusion. After reuniting their opponents the victorious infantry halted, reformed, fell back, and resumed their former position. Dismayed by the repulse of the first column, Napoleon's second column topped the height in perfect order, which bespoke the certainty of success; but the sagacity of Maitland's left wing soots the column, heavily in front, and the ground in a few minutes was covered with dead and wounded men - the confusion increased - the disorder became irremediable - the columns broke and commenced a rapid retreat. Pressed by the guards, charged by the Greys, retreat became a flight, and Wellington launched the cavalry of Vivian and Vandeleur against the mass as it roamed down the hill in hopeless disorder. Before it was possible for the French to rally and renew the fight, one grand and general attack consummated the ruin of Napoleon.

UP GUARDS AND AT 'EM.

The word was given to advance. The infantry, in one long and splendid line, moved forward with a thrilling cheer, the horse artillery galloped up and opened with case shot on the disordered masses. Instantly the allied cavalry were let loose, and charging headlong into the enemy's columns, they turned retreat into rout, and closed the history of one of the bloodiest struggles upon record. A complete panic seized upon the French, and threw away their arms to expedite their flight. The Prussian cavalry pursued the enemy from Waterloo to Genappe, and cut them down unmercifully. The roads were covered with dead and dying, and being obstructed by waggons and deserted guns, became almost impassable to the fugitives, - hence the slaughter was frightful.

THE DUKE'S DUTY

On a surface not exceeding two square miles, 50,000 dead or disabled men are lying. On the side of the victors, the total of killed and wounded, exclusive of the Prussians, exceeds 13,000 men, among whom are 600 officers and eleven generals. The total loss of the enemy amounts to not less than 40,000 men.

The lively first page announcing the great news of Waterloo

Third prize of £10 *in the* 11–14 *age group went to:*
Honor Oak School, Homestall Road, London, S.E.12.

THE NUNTIUS

NUMBER 814 — JUNE 1215

THE KING SIGNS

Historic Ceremony at Runnymede

KING JOHN.

THE GREAT CHARTER HOW IT AFFECTS YOU

FOREIGN AFFAIRS

SCOTLAND.

Donald Ban ("the fair"), brother of Guthred MacGillan was killed recently by the Turquair of Ross in an attempt to invade Moray. Readers will recall that a short time ago Guthred was captured and hanged.

WALES.

It is hoped that with the appointment of Llewyfed Rychan ("the young") as a seneschal, that the relations between the Lords of England and the Welsh would greatly improve.

HOME AFFAIRS.

It is rumoured that Emperor Frederick II has pledged himself to a crusade to the Holy Land.

SIMON de MONTFORT.

Raymond, the Count de Foix and all of the surviving nobles of Languedoc, submitted, and at the council held at Montpellier, this year, Simon de Montfort was recognised as the Count of Toulouse. The Lateran Council which was held this year confirmed Simon in his new Possessions and thus asserted the power of the church to depose a sovereign prince and to give to a stranger, his dominions.

THE KING'S SEAL.

C. JUNE 15th 1215. The King accepted the Charter, presented to him by the barons and knights and sealed it with the royal Seal.

This historic event took place at Runnymede in the presence of 2,000 barons and knights.

In the early hours of that day, the barons rode down from the crowded streets of London and encamped on the meadow. The barons and knights had assembled on one side of the River. Their brightly embroidered surcoats and emblazoned shields, the chequer transverse, the flash of mid summer sunlight on helm or hood and lance, the jingle of chain mail presented the most beautiful spectacle. On the other side of the river bank was his Majesty with his attendants who had summoned his barons to a parley and had come over from Windsor.

The Charter drafted by the honourable barons was then presented to the King and after lengthy discussions His Majesty reluctantly consented to seal the Charter.

(K.E.)

THIS piece of parchment now gives the people of England much more freedom and releases many poor souls from poverty. In future, John is not to ask for scutage or any other payment from military tenants unless they first meet in council and consent. Foreign judges are to be dismissed and only people who know the law of the land are to try Englishmen. No one will be punished without trial or fined so heavily that he is ruined.

Already the royal clerks are making copies of this great document to send all over the land so that all might know what the King has promised.

There are rumours that King John is collecting together an army to fight the now delighted barons. I interviewed several people of different classes and asked them to comment on the signing of the Magna Carta. They made such remarks as:

"I think it will be good for England"

"Will soon be rich again"

Some said things that could not be printed here as it would be treason. Some were sarcastic, cynical and others praised the arrangement.

Whatever the future holds, the signing of the Magna Carta at twelve fifteen at Runnymede is down in history as one of the greatest political events of our time.

(L.E.)

PEASANTS.

Before the Magna Carta was signed, the King's officers could seize goods belonging to peasants for the King's needs. This is now forbidden. They are not to acquire horses or carts unless the owner consent. All the peasants are not to be forced to work at building bridges.

ENCHANTS AND TOWNSPEOPLE.

The Londoners are specially favoured, for the King will no longer force them to pay aids without their agreement. No other town obtains this privilege. Another section gives special protection to foreign merchants trading in England. The King often used to seize them and confiscate their goods, and tax them. This is now forbidden.

KNIGHTS.

The knights gain very much. It says that they are not to be forced, to do any more duties than they should do. Now, their relief is fixed at 5 pounds, but before it was much more. The knights gain more from the Magna Carta than any other class except the barons.

BARONS.

The barons will benefit much from the signing of the Magna Carta. Most of the rules will probably become part of the law, and this means that if there is a dispute between the King and the barons, the barons can appeal to the law.

LAW. JUSTICE.

The Magna Carta aims to separate justice from politics. It lays down that ordinary actions between parties are to be dealt with by judges. Secondly it states that money fines are to fit the crime and are not to be too large. Thirdly, it states that the King is not to deny justice to anyone, delay it or sell it. Finally it attempts to stop the King from punishing his subjects by unlawful methods.

THE CHURCH.

It states that the English Church is to be free to enjoy its rights and liberties. Elections to offices in the Church are to be made freely by the clergymen concerned, without interference by the King.

(V.T.)

ROBERT FITZ-WALTER now emerges as a most influential leader. Since he was chosen to lead the barons of East Anglia and others early this year, he has proved his leadership despite the dubbed and inappropriate title of "Marshal of the army of the Lord and of Holy Church".

(S.T.)

'The Nuntius' exults over 'Magna Carta'

Second prize of £15 *in the* 11–14 *age group went to:*
Ellon Academy, Ellon, Aberdeenshire.

MOSCOW BURNS

15th September, 1812

'AS I stand here a few miles from Moscow I can see an ominous red glow in the sky that confirms reports that Moscow, the city of my birth, is on fire.

'Occasionally a flame shoots into the sky: this great city is rent asunder by long, greedy flames which leap at any building yet untouched in a feverish haste to devour all. . . .'

Thus did Yuri Antonov, Ellon Academy's special correspondent in Moscow, report; and the editorial attitude is similarly emotional, praising the bravery of the Russians who had burned their great city, and crowing over the plight of the 'Corsican tyrant', faced with the oncoming Russian winter, the hostile people, and the Russian military genius, Kutusov.

Other events are noted: the doings of British troops in the Spanish Peninsula; war with America; the slave trade which is being conducted on an enormous scale; and a new theatre which has been opened in London.

RETURN OF ENTRIES

We very much regret that we cannot return entries for the Historical Newspaper Competition except in cases where a specific request and the cost of postage has been enclosed.

Second prize of £15 *in the over* 14 *age group went to:*
The Marist Convent, Paignton, South Devon.

CAESAR MURDERED

Dictator stabbed as Senate meets

16th March, 44 B C

'THIS morning Caius Julius Caesar, perpetual dictator of Rome, was assassinated by a group of disaffected Senators, who claim that they have liberated Rome from a tyrant by the only possible means.'

The *Acta Diurna* proceeds with a sober analysis of the effect of this assassination on the whole Roman world. 'Who will rule the Empire now,' it wonders, 'Mark Antony or Brutus?' Cicero emerges as a key figure; and, while the supporters of Caesar and Brutus eye each other with suspicion, 'Lepidus keeps order in the silent city'. There is an able obituary of Julius Caesar: 'It is difficult to sum up Julius Caesar by ordinary human standards, because Caesar was never quite human to many of us . . . we still felt that there was something superhuman in the way he inspired devotion in his soldiers, his skill as a general, his brilliant administration of affairs as Dictator, and his almost contemptuous mercy to his beaten enemies.'

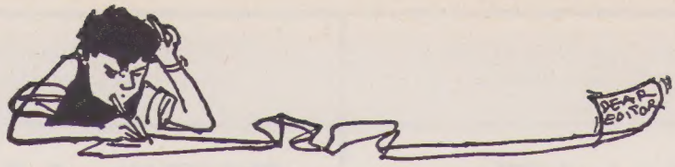
Third prize of £10 *in the over* 14 *age group went to:*
St George's Girls' School, Macalister Road, Penang, Malaya.

The above school was given a prize for two entries submitted. One was the most unusual subject to be chosen in the whole competition: warfare between secret societies in Penang in the 19th century. The other was more recent: the Japanese capture of Malaya in the Second World War. 'Malaya Taken'; 'Japs Triumph', scream the headlines. There is also a rather plaintive editorial asking: 'Has Britain really deserted us?'

Third prize of £10 *in the under* 11 *age group went to:*
St Andrews Junior Girls' School, West Street, Farnham, Hampshire.

A delightful glimpse into the provincial world of 17th-century Farnham is given by *Ye Farnham News*, which tells of King Charles I's visit to the town in 1648. The people of Farnham received him with mixed feelings because the castle was in the hands of the Parliamentary soldiers. There are many intriguing news items, like the one headed: 'Does the King wear a crown under his hat?' In fact, it transpired that he did not.

You write – thousands read!



A Discovery

DEAR EDITOR—In *Knowledge News* dated 9th June there was an interesting letter from John Gill about brasses and brass-rubbings.

In Herne Church there are several brasses dating from 1430 to 1605. Last year some cottages near the church were demolished and a small brass of a boy and girl was found. This was later proved to be part of one of the church brasses, put there in 1605 but discovered to be missing in 1790.

The children in the brass were called John and Sarah Sea, and were 17 and 16 years old.

Sarah Gough (*age* 12),
34 *St Annes Drive*,
Herne Bay, *Kent*.

Birthday Wishes

DEAR EDITOR—A friend, congratulating George Bernard Shaw on his 80th birthday, said, 'I hope we shall have the joy of celebrating your 90th birthday.' Shaw replied, 'Why not? You all look fine and healthy!'

Eamonn Bannan (*age* 15),
Dun Naoise, *Durrow*,
Portlaoise, *Laois*, *Eire*.

Taped

DEAR EDITOR—My hobby is tape-recording. We have a club at school, of which I am vice-president, where other enthusiasts can meet and record various projects.

Our first attempt, *Dr Jekyll and Mr Hyde* from the novel by Robert Louis Stevenson, was a failure. But our last recording, called *Satire*, was much more successful. It was based on *That Was The Week That Was*.

Our next attempt is to be *The Secret of the Weed*, a thrilling science-fiction story written by two members of the club.

John Harrison,
16 *Pollitt Street*,
Barnsley, *Yorkshire*.

A Long, Long Time

DEAR EDITOR—Here is another 'Time Theory'. Suppose the earth was a solid metal sphere. Once a year, a fly lands on it and takes off again. How long would it take to wear away the sphere by the mere friction of the fly's feet?

Lindsay Casey,
3 *Ross Road*,
Ferrybank,
Waterford, *Ireland*.

Going Under

Park Keeper (to man in pond): 'Sorry, sir, no swimming allowed.'
Man: 'I'm not swimming – I'm drowning!'
Park Keeper: 'Oh, that's all right then.'

David Montague (*age* 9),
358 *Moffat Street*,
Glasgow E.5.

Hero or Hog?

DEAR EDITOR—You recently quoted the old rhyme 'The Rat, the Cat, and Lovel our dog, Rule all England under the Hog' (*Knowledge News* dated 2nd June).

Richard the Third has been called the Hog, on account of his hunched back. But there is no real evidence that he had such a defect. He was in fact a great soldier. He is called the Hog in this rhyme because of his standard, on which was a boar, or hog. Some think that this may be a play on the Roman name for York, *Eboracum*.

As for the picture we get of Richard in Shakespeare's play, this was written at the time of Elizabeth I who was a Tudor and granddaughter of Henry VII who had deposed Richard. All contemporary records of Richard's reign were destroyed, and Henry had new ones written to justify his actions.

Anyone interested in this subject should read *The Betrayal of Richard III* by V. B. Lamb, and *Richard III* by P. M. Kendall.

Janet Lewis,
121 *Crocketts Road*,
Handsworth, *Birmingham* 21

Primitive People

DEAR EDITOR—I live in central New Guinea, which is now part of Indonesia. The new red and white flag has been flying since 1st May.

The natives here are still rather primitive, and use stone tools. They smear pig grease over their bodies for warmth. Their houses are round huts about seven feet tall, with a fireplace in the centre. The bedroom is up under the roof, and the pigs usually sleep on the ground underneath. These people mostly eat sweet potatoes, pandanus fruit, sugar cane and bananas.

Wesley Dale (*age* 11),
Ninia Airstrip,
Via Sentani,
West Irian.

Maori Legends

DEAR EDITOR—I am sure that your article in *Knowledge* No. 14 has helped to clear up many misunderstandings about New Zealand and its people. One of my friends was once asked by a penfriend if she wore a grass skirt all the year round, or only in summer.

You mentioned the legend surrounding North Island, which is known as 'The Fish of Maui'. Once, many years ago (so the legend goes), there was only one island, Stewart Island, where Maui's tribe lived. Maui was a young boy. One day he asked his brothers to take him fishing with them, but they refused. So Maui crept into their canoe that night and hid under some netting. When his brothers discovered him next day, they had gone too far to turn back. They let him stay, but did not allow him to fish.

When no fish were caught, the brothers turned on Maui, saying he brought them bad luck and threatening to throw him overboard. But Maui made them let him fish, using a magic hook made of his grandmother's jawbone. Soon he caught a gigantic fish, big enough to feed the whole tribe for many years. They landed the fish, and while Maui went to tell the tribe, the brothers argued about how they should share it. They ran about, cutting it deeply with their greenstone axes.

If you look at a map of North Island, you can see the shape of a giant ray-type fish, with Northland-Coromandel as its tail, Lake Taupo as its eye, and Wellington harbour as its mouth. The hills were formed by the strokes of the brothers' axes.

The long, straight South Island is supposed to be Maui's canoe.

There is another legend which tells why Maori statues have only three fingers on each hand. The first Maori carver was taught to carve by the sea-god, who demanded four of his fingers in exchange. After this the carver made statues which were meant to be self-portraits with only three fingers on each hand. When the statues were copied by other men, they too gave them only three fingers.

Heather Campbell (*age* 15),
46 *McFarlane Street*,
Wellington, *C.4*,
New Zealand.

Can you answer these?

Study each example given, then fill the gaps in the three that follow.

Example: Host; tosh.
1. Pear; ——.
2. Grip; ——.
3. Guns; ——.

Example: . om . ; bomb.
4. . rea . ; ——. (Two possible answers.)
5. . eve . ; ——.
6. . ro . ; ——. (Three possible answers.)

Example: Fair, fare; bare, bear.
7. ——, grate; gate, ——.
8. ——, feat; meat, ——.
9. ——, Wight; sight, ——.

Example: Had, lad, mad.
10. Oast; ——; ——.
11. Cock; ——; ——.
12. Mope; ——; ——.

ANSWERS

1. *Reap.*
2. *Prig.*
3. *Sung.*
4. *Dread, or treat (last letter same as first).*
5. *Level.*
6. *Grog, or prop, or trot.*
7. *Great, gait.*
8. *Feet, meie, or meet.*
9. *White, stie.*
10. *Roast, toast (rhyming, comparable spelling, and the first letters next possible in alphabetical order).*
11. *Dock, flock.*
12. *Pope, rope.*

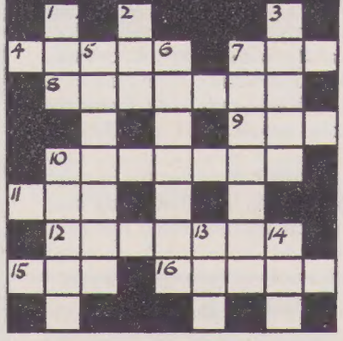
BRAIN ? BOX

1. Different terms are used for creatures going to rest – e.g. a badger *earths*. Eight such terms are: couches, forms, harbours, kennels, lodges, trains, trees, and watches.
   Can you couple the eight verbs given above with the appropriate animals in this list: boar, buck, fox, hare, hart, marten, otter, wolf?
2. Bill's uncle was born in 1910. In the year X squared his age was X–18. When was his age X years?
3. RAID, O CHOICE DEN RULER.
   This may sound an unlikely instruction, but when you have found the famous figure of whose name this is an anagram, you will then see how appropriate it is.
   Exactly the same letters are used to make this name, but the letter E is used once less than in the anagram.
   Can you get the name and say to what event in his career the sentence might refer?

ANSWERS

1. A boar couches; a buck lodges; a fox kennels; a hare forms; a hart harbours; a marten trees; an otter watches; a wolf trains.
2. 1954.
3. RICHARD COEUR DE LION; his famous Crusade.

HIGH-SPEED CROSSWORD



Clues Across

4. You find them in a book (5).
7. Moist (3).
8. Advance advertisement for a film (7).
9. Leaf drink (3).
10. Trick of hand (7).
11. None whatsoever (3).
12. Mends (7).
15. Affirmative (3).
16. South American dictator (5).

Clues Down

1. Tap behind? (3).
2. In pod or whistle (3).
3. Something for the Frenchman's head (5).
5. Iron bar gates or windows (7).
6. Resembling (7).
7. Rams (7).
10. Warning of air-raid or fire (5).
13. Electrically charged atom (3).
14. Speak (3).

Solution next week.

SOLUTION TO LAST WEEK'S CROSSWORD

ACROSS: 1, Sack; 3, Adam; 7, Wye; 8, Rowan; 9, Trestle; 13, Mouse; 15, Eel; 16, Team; 17, Espy.

DOWN: 1, Sown; 2, Clear; 4, Dew; 5, Mint; 6, Crosses; 10, Leeds; 11, Emit; 12, Slay; 14, Una.

DON'T MISS ARMAND DENIS

This week he is giving lectures about wild life in the following towns: LONDON, Festival Hall, Sunday 1st September, 3 and 7.30 pm. NEWCASTLE, City Hall, Monday 2nd September, 7.30 pm. GLASGOW, Concert Hall, Tuesday 3rd September, 7.30 pm. ABERDEEN, Music Hall, Wednesday 4th September, 7.30 pm. LIVERPOOL, Philharmonic Hall, Thursday 5th September, 7.30 pm. BRIGHTON, Dome Theatre, Saturday 7th September, 7.30 pm.

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Water gushes from a deep well

The water that runs off the ground after a storm is called surface water. In many places it runs in small streams which carry it to reservoirs where it is stored until it is needed. As surface water runs over the land it often picks up impurities, and for this reason it has to be stored, filtered, and chlorinated before it can be pumped into a town's water supply.

Of course some rainwater, instead of running off the land as surface water, penetrates downwards through porous rock until it comes to a layer through which it cannot pass. This water then travels underground along the surface of the impenetrable rock until it reaches a place where it can break out as a spring. Sometimes wells are sunk to reach water such as this. This water, whether it comes from a spring or from a well, is almost always very pure, although it is often very hard because of salts dissolved in it on its journey.

River water is usually a mixture of spring and surface water. It is often very impure, but in spite of this many towns depend on it for their supplies, although it is always filtered and chlorinated before it passes into a town's water mains. London is particularly dependent on river water, for two-thirds of its supply is taken from the river Thames just above Teddington Weir.

The need for water

Water is essential for life. No plant or animal can survive without it. Plants obtain the water they need mainly from the soil in which they grow, and in many species water makes up more than 90 per cent of the plant's weight. Some of this water is used for photosynthesis, for under the influence of the green pigment called chlorophyll in the leaves it is combined with carbon dioxide from the air to make the carbohydrates of the plant tissues.

Animals also are dependent on water. It makes up about 75 per cent of the weight of their tissues; it is needed to carry away the body's waste products in the urine; and it is needed for the formation of sweat. Less obviously, but very importantly, it is required for many of the wonderful chemical reactions which take place in the cells of an animal's body. In an indirect way animals also depend on water for the food that they eat. Many creatures are herbivorous and live solely on vegetable food which can grow only in areas with adequate rainfall, but even carnivorous animals are remotely dependent on vegetation, as either their victims or their victims' victims are almost certain to be herbivorous.

The amount of water needed by humans depends on their size, on the average temperature of the place where they live, and on the amount of manual work that they do. In a temperate climate a man doing office work needs about 5 pints a day. It is, however, unnecessary for him to drink as much as this, for about half of the required amount is obtained from the food that he eats. A person who lives in a hot country, or who does very hard manual work, may lose up to 20 pints of water a day in sweat. In these circumstances it is very important to increase the daily intake of water until it makes up for the heavy losses.

A number of animal species, including the golden hamster, are unusual in that they can live quite satisfactorily without drinking. This, however, does not mean that they do not need water; it merely means that they use it so economically that they can obtain enough for their needs by eating moist vegetable food. Nonetheless, hamsters in captivity do occasionally drink, and it is important that water should always be available for them.

Hard or soft

Rainwater is always beautifully *soft*. Soap lathers easily in it and never forms a scum, so it is much prized by housewives. In some places the water in the public supply is equally soft, but this is rather unusual. More often the public supply is *hard*. A great deal of soap is needed to form lather in hard water, and a scum invariably forms on the top.

The hardness of water is caused by various salts dissolved in it. As water percolates into the earth it often passes through porous layers of chalk, or limestone, and in doing so dissolves several salts from the rock. The most important salts in water are calcium bicarbonate ($Ca(HCO_3)_2$), calcium sulphate ($CaSO_4$), and magnesium sulphate ($MgSO_4$), and it is these which make the water hard.

When water containing calcium bicarbonate is boiled the salt is converted into calcium carbonate ($CaCO_3$) which sticks to the side of the vessel as 'fur'. Because the hardness due to calcium bicarbonate can be so easily removed in this way, it is called *temporary hardness*. Boiling will not remove either calcium sulphate or magnesium sulphate from water, and so hardness due to these salts is called *permanent hardness*. Special water softeners have been devised which can remove permanent

A prehistoric man slakes his thirst at a river

Water was one of the earliest means of transport

Cows need a lot of water to provide milk

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Water *Cover*
Mountain vegetation *2209*
Colombia – history *2212*
The Sudan *2214*
From leaves to synthetic fibres *2216*

contents

The Caucasus *2218*
Prime numbers *2220*
John Dryden *2222*
Themistocles *2223*
James Monroe *2224*

contents

hardness from water, and these are frequently installed in private houses in hard water areas.

The uses of water

The need for water has been present as long as there has been life on the earth, but in prehistory, once the bodily needs of primitive man were satisfied he probably had little use for this plentiful substance. Maybe he occasionally washed it in, maybe he sailed crude boats on it, but that was probably all.

As the centuries passed, however, mankind gradually made more and more use of water. It became a highway upon which large ships sailed, it was used in moats as a protection against enemies, and in hot and arid countries primitive irrigation schemes were undertaken to water the precious crops. The water wheel was invented as a source of power, and has since been improved upon until it has reached the efficiency of the giant turbines in modern hydro-electric powerhouses. The invention of the steam engine by James Watt in 1765 opened up all the possibilities of steam power, and water immediately became even more important.

By the beginning of the 20th century it was normal for private houses in large cities to have piped water supplies. As a result the amount of water used for domestic purposes such as washing clothes, bathing, and sanitation increased rapidly. In London in 1961 the average consumption of water per head of the population was 57 gallons per day.

Some physics and chemistry

Water is remarkable in that, of all the substances found on the earth, it is the only one which is found naturally in all three physical states – solid, liquid, and gas. In most parts of the world the temperature is such that water is a liquid, but even at these temperatures it evaporates quite rapidly to form the gas, water vapour. Below 0°C (32°F) water solidifies, or freezes, to become ice. The ice crystals are very intricate and usually take the form of a six-pointed star like the one on the front cover.

The chemical formula of water is H_2O, which indicates that water is formed from one atom of oxygen and two atoms of hydrogen bonded together. The molecules are very small indeed, and one millilitre of water (about an eggspoonful) contains approximately 30,000,000,000,000,000,000,000 of them.

A great many chemical reactions are unable to take place without water. These water-dependent reactions vary from simple ones such as the combustion of carbon monoxide in oxygen, through the more involved processes of digestion, to the complex mechanisms by which plants and animals synthesise the constituents of their tissues.

SOME USES OF WATER

Heavy water

When a very large volume of water is dissociated into its component hydrogen and oxygen by passing an electric current through it, the small amount of water left at the end of this process is found to have a density of 1·1 rather than the 1·0 of ordinary water, and is known as 'heavy water'. This strange phenomenon is due to the fact that mixed with every 6,900 molecules of hydrogen there is one molecule which is twice as heavy as ordinary hydrogen. This 'heavy hydrogen', or *deuterium* as it is called, can unite with oxygen to form heavy water, but as heavy water is a little less readily dissociated by an electric current than ordinary water, it is left behind when all the ordinary water has been dissociated.

Because there is so little deuterium in water its extraction is a very expensive process. However, heavy water has been used in quite large amounts in certain types of nuclear reactor, and also, in smaller amounts, to 'label' water used in biological experiments.